UNIVERSITAS INDONESIA

FACTORS INFLUENCING THE USE OF BED NET IN BADAKHSHAN PROVINCE OF AFGHANISTAN

THESIS

AERAJ FEROZ

NPM: 0906666613

FACULTY OF PUBLIC HEALTH

MASTER OF PUBLIC HEALTH SCIENCE PROGRAM

DEPOK

JANUARY 2011

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Proposed as one of the requirements for obtaining a degree of Master of Public Health

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STATEMENT OF ORIGINALITY PAGE

Thesis is the result of my own work,
and all good sources quoted or referenced
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ABSTRACT

Name:	Aeraj Feroz
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Title:	Factors influencing the use of bed net in Badakhshan province of Afghanistan

Malaria is a main public health problem in 109 countries and approximately 14 million people live in malaria endemic provinces in Afghanistan. This study is aimed to identify the independent predictors influencing the use of bed nets and determine the bed net coverage through a cross-sectional study with sample size of 171 households in Badakhshan province of Afghanistan. The result indicated that source of health education, number of rooms, locality of households and reading ability are the significant predictors associated with use of bed net and the coverage of bed net was 18.8% among surveyed population. As a conclusion, the big proportion of people who reported the habit of sleeping under bed net, were the respondents who received malaria related health messages from (TV, radio, newspapers, workplace and mosque), lived in urban area, owned less number of rooms and were able to read.

Key words:

Malaria, bed net, influencing factors, health education, locality, reading ability

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LIST OF ABBREVIATIONS

BPHS	Basic Package of Health Services
CSO	Central Statistic Office
ELISA	Enzyme-Linked Immunosorbent Assay
EMRO	Eastern Mediterranean Regional Office
EPHS	Essential Package of Hospital Services
GNI	Gross National Income
HDI	Human Development Index
ITN	Insecticide Treated Nets
KAP	Knowledge, Attitude and Practice
LLIN	Long-lasting Insecticidal Nets
MDG	Millennium Development Goal
MoPH	Ministry of Public Health
NGO	Nongovernmental Organization
NMLCP	National Malaria and Leishmaniasis Control Program
RDT	Rapid Diagnostic Tests
UNDP	United Nations Development Program
UNICEF	United Nations International Children Emergency Fund
USAID	United Stat's Agency for International Development
WB	World Bank
WHO	World Health Organization

CHAPTER I
INTRODUCTION

1.1 Background

1.1.1 Global situation of malaria

Malaria is one of the most common infectious disease and the main health challenge worldwide. It is a major public health problem in around 109 malaria endemic countries. “About 3.3 billion people - half of the world's population - are at risk of malaria. Every year, this leads to about 250 million malaria cases and nearly one million (1,000,000) deaths. People living in the poorest countries are the most vulnerables. Malaria causes an average loss of 1.3% of annual economic growth in countries with intense transmission. It traps families and communities in a downward spiral of poverty, disproportionately affecting marginalized and poor people who cannot afford treatment or who have limited access to health care. Malaria has lifelong effects through increased poverty and impaired learning. It cuts attendance at schools and workplaces.” (WHO, 2010). According to the World Malaria Report_2009 there are (109) malaria endemic countries in the world and among them around 31 countries are listed as malaria high- burden countries. The report indicates that an estimated 243 million malaria cases and 863 000 malaria deaths occurred in 2008. (WHO, 2009).

Malaria is mostly widespread in Africa, Asia, Middle East and America. The Roll Back Malaria /WHO ranks the regions based on number of endemic countries as follow : (Roll Back Malaria Program, 2010)

- Africa 50 Malarious Countries
- Asia-Pacific 20 Malarious Countries
- The Americas 22 Malarious Countries
- Middle East and Eurasia 17 Malarious Countries

1.1.2 Malaria in WHO-Eastern Mediterranean Region

Member States of the World Health Organization (WHO) are grouped into six regions. The Eastern Mediterranean Region (EMRO) consists of 21 countries including Afghanistan (WHO, 2010). "About 48% of the population of the region live in areas under risk of malaria transmission. In 2006, the estimated annual number of malaria cases were about 10 million, while the reported number was 3.6 million (only confirmed cases from Pakistan are included); 99% of those cases occur in six countries (Afghanistan, Djibouti, Pakistan, Somalia, Sudan and Yemen)" (WHO, 2010)

1.1.3 Malaria in Afghanistan

Malaria is a major public health problem in Afghanistan. According to the Malaria Annual Report (2008_MoPH/NMLCP), "Approximately 14 million people live in malaria endemic provinces and are exposed to high risk of the disease. In 2008, 19.87 cases of malaria per 1000 population (467123) were reported. This shows 0.87 % increase in number of cases as compared to 2007. This increase is due to the expanded coverage of public health care system and improvement in reporting. In 2008, 1675 health facilities reported malaria cases as compared to 1252 in 2007 (33.8% increase in number of health facilities)" (NMLCP, 2008).

According to the World Malaria Report, Afghanistan had a total number of 4,434 malaria inpatient cases, 46 attributed deaths and around 467,123 outpatient cases in 2009. A total of 549,494 microscopic slides / rapid diagnostic tests were reported which among them 82,564 microscopic slides and RDTs were positive. From positive cases 4,360 cases were plasmodium falciparum and 78,204 of plasmodium vivax. The total number of cases at the community level was 159,509. (WHO, 2009)

Altitude, agriculture practices (rice cultivating fields) and climate (Temperature and rainfall) are the main determinants and contributing parameter to the duration and intensity of malaria in Afghanistan.

Low access to basic health services, poverty, low level of education, drought and deforestation, geographical characteristics and socio-cultural status of the communities are the main contributing factors to high morbidity and mortality of malaria in Afghanistan. “According to WHO report; Afghanistan has the second highest burden of malaria in EMRO and the forth worldwide outside Africa .Malaria occurs at altitudes below 2,000 meters above sea level and is most prevalent in snow-fed river valleys and areas used for growing rice in Afghanistan”. (NMLCP, 2008) .

Transmission of malaria is seasonal starting from June to November with few transmission (depending on the species of plasmodium) occurring between December and April. Children under five years old, pregnant women (with low immunity), adult male working at the forms, and travelers moving into the endemic areas are the population at risk of malaria in Afghanistan.

1.1.4 Malaria stratification in Afghanistan (Distribution of disease)

WHO and Ministry of Public Health in Afghanistan have divided the country into three epidemiological strata according to the observed trends of morbidity and mortality, altitude, agriculture practices (rice growing) and climate condition of provinces. Total 14 provinces (first stratum) are counted as malaria high risk provinces (NMLCP, 2008):

- First stratum includes high risk areas (Badakhshan, Badghes, Balkh, Baghlan, Faryab, Herat, Helmand, Kandahar, Khost, Kunar, Kunduz, Laghman, Nangarhar and Takhar provinces)
- Second stratum is considered as a low risk area (Daikundi, Farah, Jauzjan, Kabul, Kapisa, Logar, Nimruz, Uruzgan, Paktia, Paktika, Parwan, Samangan, Sar-e-pul, Wardak and Zabul provinces)
- Third stratum has less potential for malaria transmission (Central Highlands of Baghlan, Bamyan, Ghazni, Panjshir, Nuristan and Ghor.)

Figure 1 Malaria stratification in Afghanistan (Malaria Annual Report, 2008)

1.1.4.1 Plasmodium and vector species in Afghanistan

There are two prevalent species of plasmodium in Afghanistan, the *Plasmodium vivax* (the most prevalent) and the *Plasmodium falciparum* (The less prevalent but the fatal one).The main vector species in Afghanistan which are most predominant for malaria transmission are *An. stephensi1* and, *An. culicifacies* in the Eastern and Southern provinces of Afghanistan. *An. pulcherrimus* and *An. hycranus* are found in the rice fields and mountain streams in Northern Afghanistan. Other malaria vectors include *An. fluviatilis, An. annularis* and *An. superpictus* (NMLCP, 2008).

1.1.4.2 Afghanistan profile

Afghanistan is a land-locked country located in the Southern Asia with a total of 652,230 sq km area. There are 34 provinces with 398 districts and around 32509 villages in Afghanistan (According to the latest civil division by Ministry of Interior Affairs). Over 35 years of war and conflict , Afghanistan has been faced to extreme poverty, political instability, impaired infrastructure and large gender disparities . "Afghanistan, with a per-capita income of less than US$ 570, is among the least developed countries in the world with 70% of the population living in extreme poverty and health vulnerability." (WHO, April 2009).

The 2009 Human Development Index of the United Nations ranks Afghanistan at 181 out of 182 countries. Based on this year's HDI (which refers to year 2007), HDI for Afghanistan is 0.352. (UNDP, 2007). According to the latest data from World Bank, 42% of population lives below the national poverty line. The World Bank ranks Afghanistan at 120 out of 191 countries based on GDP (Gross Domestic Product). According to the World Bank , Afghanistan has the GDP of US$10.6 billion (10,624 Millions) and the Gross National Income or GNI of US$10.6 billion (10,603 Millions) in 2008. (WB, 19 April 2010). "Average adult illiteracy rate is 71% [female illiteracy as high as 86%]. More than 1 million primary school age girls not in school [in two provinces, girls' nonenrolmen = 99%] 4.89 million children enrolled in schools with 4.25 millions in primary grades of 1-6. (About 402,427 new girls -100.03% gross enrolment of primary school entry)" (UINCEF, 2007).

More than 6.2 million students attend Grades 1-12 today, the largest figure in the history of Afghanistan. Approximately 2.2 million students are girls – Female participation has exceeded the pre-Taliban period (World Bank, 2010).

1.1.4.3 Health Status of Afghanistan

Afghanistan is currently faced with the following key health problems: (WHO, 2006)

- High level of infants mortality rate
- High level of under 5 mortality rate
- One of the world's highest maternal mortality ratio
- Elevated level of malnutrition and anemia
- High incidence of communicable diseases (TB and Malaria)
- Mental health problems and disability

Table 1 Afghanistan Health and Demographic Indicators

Indicators	Value	Year	Source
Total population (Figure per 000)	23993.5	2009	CSO
life expectancy at birth (years)	44	2008	UNICEF
Crude birth rate (per 1000 population)	47	2008	UNICEF
Crude death rate (per 1000 population)	29	2008	UNICEF
Total fertility rate (per women)	6.6	2008	UNICEF
Maternal Mortality Ratio (100,000 live births)	1600	2003-2008	UNICEF
Under -5 mortality rate (per 100 live births)	257	2008	UNICEF
Infant mortality rate (per 100 live births)	165	2008	UNICEF
Population at risk for malaria (Million)	14	2009	NMLCP

1.1.4.4 Health system of Afghanistan

The Ministry of Public Health has been established a stewardship role while delegating health service delivery to the private sector (NGOs) within clear and manageable policies such as Basic Package of Health Services and Essential Package of Hospital Services. The intervention of three major donors (USAID, European Commission & the World Bank) is coordinated successfully in the form of the aforementioned policy documents and other standard health packages.

1.2 Problem statement

Malaria is a life-threatening infectious disease which is caused by parasites that are transmitted to people through the bites of infected mosquitoes. It could be transmitted to people of all ages. It is commonly associated with poverty and has negative impact and deteriorating role on the economical development of the endemic countries. The high expenditure of treatment and impaired economical productivities resulting from malaria lead to poverty among affected populations. Malaria cuts attendance at schools and workplaces resulting increased poverty and impaired learning. The pregnant women, children under five years of age and adult male (formers) are the main vulnerable people. The other vulnerable groups are returnees, internal displaced people and nomads.

Around half of the population in Afghanistan (14 Million) is at risk of malaria. Insecurity, low coverage of basic health services, poverty, harsh terrain, geographical barriers and some socio-cultural constraints affects people's access to the health facilities and basic curative services. Considering the mentioned facts, curative services are hard to obtain sometimes and also very late in case of some complicated type of disease among the poor people. Therefore, preventive measures are the most efficient and effective interventions to reduce morbidity and mortality of malaria in Afghanistan context. On the other hand, the global malaria control strategies has been extensively focused on the vector control approaches rather than curative aspects due to drug resistance phenomena, high cost of the malaria treatment , people's perceived knowledge and attitude , and health care seeking behavior of the vulnerable communities. Preventing vector contact with people is one of the most recommended interventions by WHO and other stakeholders. Data show significant progress in scaling up the preventive efforts due to increased funds and attention by concerned organizations and partners worldwide.

While bed net usage (ITNs and LLINs) are the most efficacious and cost effective strategy for malaria control, still sufficient coverage of bed net ownership and usage is not achieved among some endemic countries.

In Afghanistan, ITNs represent one of the most feasible and appropriate options for obtaining protection against malaria. Despite extensive efforts by the international organizations and the National Malaria and Leishmaniasis Control Program (MoPH _ NMLCP) still the bed net coverage and utilization is low in Afghanistan. According to the result of Malaria Indicator Survey (2008) conducted by WHO and NMLCP, the bed net coverage was (26.7%) and only (22.1%) of the surveyed population reported the habit of sleeping under bed nets (Randa et al, 2008).

A cross-sectional prevalence, knowledge, attitudes and practices (KAP) survey was conducted in four districts (Shinwar, Momandara, Batikot, and Nazian) in Nangarhar province in the Eastern region of Afghanistan. According to this study, among those whose household owns an ITN, 33% and 32% reported that everybody or specifically, children usually sleep under the ITN respectively. However, when asked whether they had used an ITN last night, only 26% reported that they had. (Toby Leslie et al , 2004).

1.2.1 Rational and justification

The high burden of malaria in Afghanistan and magnitude of the consequent problems necessitates for conducting of the health researches in this country. Researches could obtain the real facts that are still unexplored and might be used for remedial interventions and evidence-based planning. Unavailability of valid epidemiological data is a big concern in Afghanistan. Little is known about the people's perception on the preventive measures as well as the main barriers averting them from these services. Hence, the need for conducting more health researches is obvious. Due to scarcity of the health researches, access to reliable facts and figures about the determinants of bed net usage is difficult. Some of the available data are based on the localized surveys undertaken in area with reasonable security which is not necessarily representative for all.

1.2.2 Reasons for selecting Badakhshan as a study site

1. Badakhshan province is one of the 14 malaria high risk province which is included in the first strata of malaria endemic provinces.

2. In September 2007, malaria outbreak was reported from Faiz Abad city, the center for Badakhshan province. "Established active surveillance system identified a total of 336 cases of *P. falciparum*. Through the effective response of the Program and the Partners, the outbreak was controlled within 2 weeks with no mortality" (Randa et al, 2008).

3. No specific study has been conducted so far to determine the coverage of bed net use and identify the factors influencing bed net utilization in this province.

4. Badakhshan is one of the isolated provinces of Afghanistan having remote districts and hard to access villages. The distinctive geographical barriers, low coverage of basic health services, harsh terrain comparing to other Malaria endemic provinces, scatter population, poverty, lack of roads and transportation facilities are the existed problems affecting the health of communities.

5. Badakhshan has the highest Maternal Mortality Ratio in the world. The maternal mortality ratio (per 100 000 live births) was estimated around 6507 (5026–7988) in Ragh during 1999-2002 (Linda A Bartlett et al 1999-2002). Pregnant women are at increased risk for contracting malaria because of their immune-compromised status. malaria also contributes to maternal anemia, which can lead to hemorrhage, spontaneous abortion, neonatal death and low-birth weight.

1.3 Research Question

What are the factors influencing the use of bed net in Badakhshan province of Afghanistan?

1.4 Objectives

1.4.1 General Objective

The overall purpose of this study is to identify the independent predictors influencing the use of bed nets in Badakhshan province, Afghanistan.

1.4.2 Specific Objectives

1. To identify the association between the background characteristics of the respondents and the use of bed nets. Such as (sex, age, reading ability, employment status, family size, number of rooms, economic status and locality of household).

2. To identify the association between malaria related health knowledge) of the respondents and bed nets usage. (including health education and source of health education

3. To identify the association between availability of bed net and use of bed net.

4. To define the coverage of bed net among surveyed population.

5. Finally, to determine the strongest predictor / most dominant factor on bed net usage.

1.5 Benefits of the study

In the current situation of Afghanistan, there is a big demand for health system researches to obtain the reliable data and explore the main barriers averting people from preventive measures. Identifying the factors which influence the use of bed net will help the decision-makers and program managers to prioritize the area of interventions. It also leads to the appropriate and evidence-based remedial actions. The results will direct the future intervention toward the most problem –oriented activities. The result also could be shared and be used for the planning purposes at the national level and for the spatial management of the health related problems at the different provincial and district levels.

1.6 Scope of the study

The data used for this study is secondary data and initially was collected for the Malaria Indicator Survey (2008) conducted by NMLCP and WHO. (Randa et al, 2008). This current study (2010) is aimed to determine factors associated with the use of bed nets in Badakhshan province, Afghanistan. The study mainly focuses on the relevant socio-demographic characteristics of the target population along with the anticipated barriers preventing the people to use the bed net as a best protective measure in Afghanistan context. This study will contribute to find out the factors in favor of bed net use and also obstacles of bed net usage among the people which are living in different localities, with different socio-economic status. The study will explore the coverage of bed net use which is still unknown in some provinces. It will assess the knowledge of people toward the use of bed nets and perceived benefits. The permanent resident of both sexes and all age group in the target provinces represents the population of this survey.

CHAPTER II
LITERATURE REVIEW

2.1 What is malaria?

Malaria is a major global health problem and currently known as one of the main re-emerging world-wide public health issues. “Malaria is an infectious disease caused by the parasite called Plasmodia. There are four identified species of this parasite causing human malaria, namely, *Plasmodium vivax*, *P. falciparum*, *P. ovale* and *P. malariae*. It is transmitted by the female anopheles mosquito. It is a disease that can be treated in just 48 hours, yet it can cause fatal complications if the diagnosis and treatment are delayed. It is re-emerging as the # 1 Infectious Killers and it is the Number 1 Priority Tropical Disease of the World Health Organization” (Kakkilaya, 2006).

2.2 Epidemiology of Malaria

Malaria is a major public health problem in around 109 Malaria endemic countries. “About 3.3 billion people - half of the world's population - are at risk of malaria. Every year, this leads to about 250 million malaria cases and nearly one million (1,000,000) deaths. People living in the poorest countries are the most vulnerable. Malaria causes an average loss of 1.3% of annual economic growth in countries with intense transmission. It traps families and communities in a downward spiral of poverty, disproportionately affecting marginalized and poor people who cannot afford treatment or who have limited access to health care. Malaria has lifelong effects through increased poverty and impaired learning. It cuts attendance at schools and workplaces.” (WHO, 2010). According to the 2009 World Malaria Report, there are (109) malaria endemic countries in the world and among them around 31 countries are listed as Malaria high- burden Countries. (WHO, 2009). The report indicates that:

- An estimated 243 million malaria cases occurred in 2008
- An estimated 863 000 malaria deaths occurred in 2008

Malaria is mostly widespread in Africa, Asia, Middle East and America. The Roll Back Malaria /WHO divides the number of endemic countries in different regions (Roll Back Malaria Program, 2010):

- Africa 50 Malarious Countries
- Asia-Pacific 20 Malarious Countries
- The Americas 22 Malarious Countries
- Middle East and Eurasia 17 Malarious Countries

The following tables show that latest key malaria of facts of the world based different malaria endemic regions.

Table 2 World's Key Malaria Facts

Annual cases of malaria	Globally: Africa: Asia: Middle East: Americas:	247 million 212 million 21 million 8.1 million 2.7 million
Annual deaths from malaria	Globally: Africa: Middle East: Asia: Americas:	881,000 801,000 38,000 36,000 3,000
Figures on malaria deaths	91% of deaths were in Africa 85% of deaths were in children under 5 years of age 4% of deaths were in South-East Asia region 4% of deaths were in Eastern Mediterranean region	
Population at risk	3.3 billion (half of the world population)	
Number of countries affected	109 (35 countries - 30 in Sub-Saharan Africa and 5 in Asia - account for 98 percent of global malaria deaths)	
Top five countries for malaria numbers	Nigeria: 57,506,000 Democratic Republic of the Congo: 23,620,000 Ethiopia: 12,405,000 United Republic of Tanzania: 11,540,000 Kenya: 11,342,000	
Top five countries for malaria deaths	Nigeria: 225,424 Democratic Republic of the Congo: 96,113 Uganda: 43,490 Ethiopia: 40,963 United Republic of Tanzania: 38,730	

Sources: Roll Back Malaria, 2010

2.3 Etiology

The plasmodium parasite is the cause of Malaria. "About 170 species of plasmodium exist, but only four cause malaria in humans:

- P. falciparum. This species, predominant in Africa, produces the most severe symptoms and is responsible for most malaria deaths.
- P. vivax. This species, found mostly in tropical areas of Asia, produces less severe symptoms but can remain in the liver and cause relapses for up to four years.
- P. malariae. This species, found in Africa, can cause typical malaria symptoms, but on rare occasions it can remain in the bloodstream for years without producing symptoms. In these cases, person may pass on the parasite to a mosquito or to another person through a blood transfusion.
- P. ovale. This species is found mostly in West Africa. Although rare, it can also remain in the liver and cause relapses for up to four years" (Mayo, 2009).

(Asexual phase in human body and sexual phase in the mosquito)

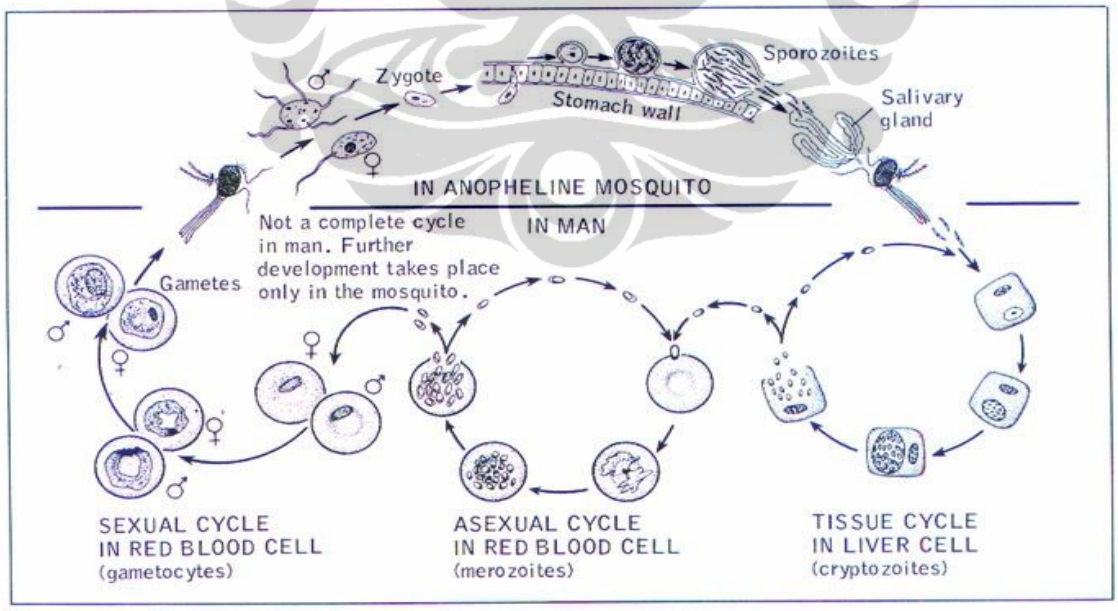

Figure 2 Lifecycle of malaria parasites

Source: (Redrawn and modified from Blacklock and Southwell_From R.D.Bames)

2.4 Life cycle of malaria parasites

2.4.1 Asexual phase in the human host

Tissue schizogony (Pre- erythrocytic schizogony): "This phase starts with the inoculation of the parasite into the human blood by the bite of a female anopheles mosquito. Within half an hour, the sporozoites reach the liver and invade the liver cells. The mechanism of targeting and invading the hepatocytes with this rapidity is not yet clear. Within the liver cells, the trophozoites start their intracellular asexual division. At the completion of this phase, thousands of extra erythrocytic merozoites are released from each liver cell. The time taken for the completion of the tissue phase is variable, depending on the infecting species; *(8 - 25 days for P. falciparum, 8 - 27 days for P. vivax, 9 - 17 days for P. ovale, and 15 - 30 days for P. malariae)* and this interval is called as *pre-patent period.*

In case of *P. vivax* and *P. ovale,* some sporozoites may go into hibernation - the *cryptobiotic phase*- in which they are called as *hypnozoites.* They can lie dormant for months or years and on reactivation they cause clinical relapse (Kakkilaya, 2006).

Erythrocytic schizogony: The merozoites released from the liver cells attach onto the red blood cell membrane and by a process of invagination, enter the red cell. Within the red blood cell, the asexual division starts and the parasites develop through the stages of rings, trophozoites, early schizonts and mature schizonts; each mature schizont consisting of thousands of erythrocytic merozoites. These merozoites are released by the lysis of the red blood cell and they immediately invade uninfected red cells. This repetitive cycle of invasion - multiplication - release - invasion continues. The intra erythrocytic cycle takes about 48 hours in *P. vivax, P. ovale* and *P. falciparum* infections and 72 hours in case of *P. malariae* infection. It occurs synchronously and the merozoites are released at approximately the same time of the day. The contents of the infected cell that are released with the lysis of the RBC stimulate Tumor Necrosis Factor and other cytokines, which results in the characteristic clinical manifestations of the disease.

A small proportion of the merozoites in the red blood cells undergo transformation into gametocytes - male and female. Mature gametocytes appear in the peripheral blood after a variable period and enter the mosquito when it bites an infected individual. (Appear on the 5th day of primary attack in P. vivax and P. ovale, and thereafter become more numerous; appear at about 5 - 23 days after primary attack in P. malariae; appear after 8 - 11 days of the primary attack in P. falciparum, rising in number until 3 weeks and falling thereafter, but may circulate for several weeks) (Kakkilaya, 2006).

2.4.2 Sexual phase in the mosquito

Sporogony: The gametocytes continue their development in the mosquito. The male and female gametes fuse and form into a zygote. This transforms into an ookinete which penetrates the gut wall and becomes an oocyst. The oocyst divides asexually into numerous sporozoites which reach the salivary gland of the mosquito. On biting a man, these sporozoites are inoculated into human blood stream. The sporogony in the mosquito takes about 10 - 20 days and thereafter the mosquito remains infective for 1 - 2 months" (Kakkilaya, 2006)

2.5 Transmission of malaria

2.5.1 Mosquito bite

Principal mode of spread of malaria is by the bites of female anopheles mosquito. The female anopheles mosquito is the vector for human malaria. "Some 60 species of this mosquito have been identified as vectors for malaria, and their distribution varies from country to country. When a mosquito bites an infected individual, it sucks the gametocytes, the sexual forms of the parasite, along with blood. These gametocytes continue the sexual phase of the cycle and the sporozoites fill the salivary glands of the infested mosquito. When this female mosquito bites the man for a blood meal, which it needs to nourish its eggs, it inoculates the sporozoites into human blood stream, thus spreading the infection. The female anopheles mosquito bites man between 5 PM and 7 AM, with maximum intensity at midnight (Kakkilaya, 2006).

2.5.2 Other modes of transmission

Rarely malaria can spread by the inoculation of blood from an infected person to a healthy person. In this type of malaria, asexual forms are directly inoculated into the blood and pre-erythrocytic development of the parasite in the liver does not occur. Therefore, this type of malaria has a shorter incubation period and relapses do not occur (Kakkilaya, 2006).

2.5.3 Blood transfusion (Transfusion malaria)

This is fairly common in endemic areas. Following an attack of malaria, the donor may remain infective for years (1-3 years in *P. falciparum*, 3-4 years in *P. vivax*, and 15-50 years in *P. malariae*.) Most infections occur in cases of transfusion of blood stored for less than 5 days and it is rare in transfusions of blood stored for more than 2 weeks. Frozen plasma is not known to transmit malaria. The clinical features of transfusion malaria occur earlier and any patient who has received a transfusion three months prior to the febrile illness should be suspected to have malaria.

Donor blood can be tested with indirect fluorescent antibody test or ELISA, and direct examination of the blood for the parasite may not be helpful.In endemic areas, it is safe to administer full course of chloroquine to all recipients of blood transfusion. In transfusion malaria, pre-erythrocytic schizogony does not occur and hence relapses due to dormant hepatic forms also does not occur. Therefore, treatment with primaquine for 5 (or14) days is not indicated.

2.5.4 Mother to the growing fetus (Congenital malaria):

Intrauterine transmission of infection from mother to child is well documented. Placenta becomes heavily infested with the parasites. Congenital malaria is more common in first pregnancy, among non - immune populations.

2.5.5 Needle sticks injury:

Accidental transmission can occur among drug addicts who share syringes and needles" (Kakkilaya, 2006).

2.6 Factors affecting the Transmission of Malaria :

"Transmission is more intense in places where the mosquito is relatively long-lived (so that the parasite has time to complete its development inside the mosquito) and where it prefers to bite humans rather than other animals. For example, the long lifespan and strong human-biting habit of the African vector species is the underlying reason why more than 85% of the world's malaria deaths are in Africa.

Human immunity is another important factor, especially among adults in areas of moderate or intense transmission conditions. Immunity is developed over years of exposure, and while it never gives complete protection, it does reduce the risk that malaria infection will cause severe disease. For this reason, most malaria deaths in Africa occur in young children, whereas in areas with less transmission and low immunity, all age groups are at risk.

Transmission also depends on climatic conditions that may affect the abundance and survival of mosquitoes, such as rainfall patterns, temperature and humidity. In many places, transmission is seasonal, with the peak during and just after the rainy season. Malaria epidemics can occur when climate and other conditions suddenly favour transmission in areas where people have little or no immunity to malaria.

They can also occur when people with low immunity move into areas with intense malaria transmission, for instance to find work, or as refugees" (WHO, 2010)

2.7 Who is at risk of Malaria?

Approximately half of the world's population is at risk of malaria. “Most malaria cases and deaths occur in sub-Saharan Africa. However, Asia, Latin America, and to a lesser extent the Middle East and parts of Europe are also affected. In 2008, malaria was present in 109 countries and territories. Specific population risk groups include:

- **Young children** in stable transmission areas who have not yet developed protective immunity against the most severe forms of the disease. Young children contribute the bulk of malaria deaths worldwide.
- **Non-immune pregnant women** are at risk as malaria causes high rates of miscarriage (up to 60% in P. falciparum infection) and maternal death rates of 10–50%.
- **Semi-immune pregnant women** in areas of high transmission. Malaria can result in miscarriage and low birth weight, especially during the first and second pregnancies. An estimated 200 000 infants die annually as a result of malaria infection during pregnancy.
- **Semi-immune HIV-infected pregnant women** in stable transmission areas are at increased risk of malaria during all pregnancies. Women with malaria infection of the placenta also have a higher risk of passing HIV infection to their newborns.
- **People with HIV/AIDS** are at increased risk of malaria disease when infected.
- **International travelers from non-endemic areas** are at high risk of malaria and its consequences because they lack immunity.
- **Immigrants from endemic areas and their children** living in non-endemic areas and returning to their home countries to visit friends and relatives are similarly at risk because of waning or absent immunity” (WHO, 2010).

2.8 Classification of Malaria

According to the severity of the disease, Malaria could be divided into two types (Ipca 2010):

1. Uncomplicated (Benign)
2. Complicated (Malignant)

The Uncomplicated Malaria has the following characteristics:

- Relatively milder disease
- Generally caused by *P. vivax*
- Seldom fatal
- The chance of involvement of other organs (complications) is much less

The Complicated Malaria has the following characteristics:

- Severe
- Rapid downhill course
- Caused mainly by *P. falciparum* and rarely by *P. vivax*
- Poor prognosis (outcome)
- Also called sever malaria

2.9 Signs and symptoms of Malaria

Common symptoms of malaria: In the early stages, malaria symptoms are sometimes similar to those of many other infections caused by bacteria, viruses, or parasites. Symptoms may include (WebMD, 2010):

- Fever
- Chills
- Headache.
- Sweats
- Fatigue
- Nausea and vomiting

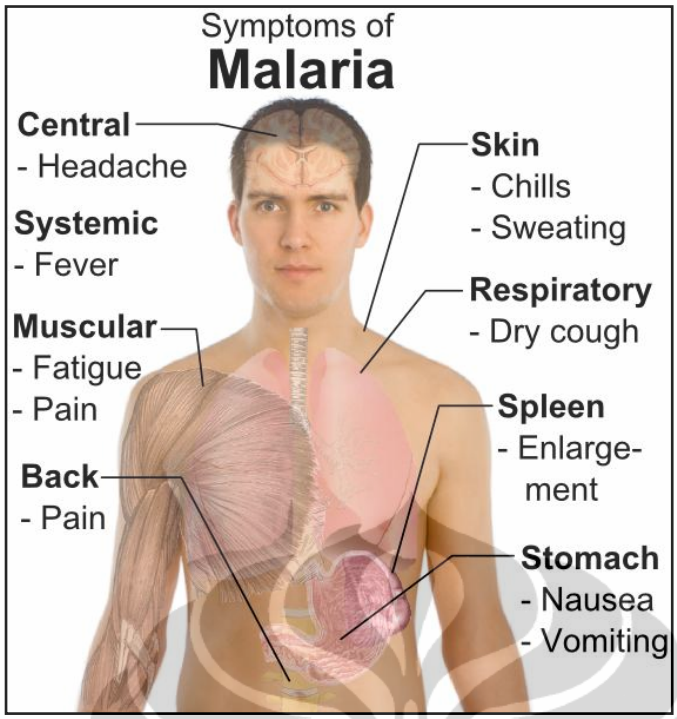

Figure 3 Symptoms of malaria (en.wikipedia.org/wiki/Malaria)

The main symptoms of malaria include fever, chills, arthralgia (joint pain), vomiting, anemia (caused by hemolysis), hemoglubinuia, retinal damage and convulsion. "The classic symptom of malaria is cyclical occurrence of sudden coldness followed by rigor and then fever and sweating lasting four to six hours, occurring every two days in *P. vivax* and *P. ovale* infections, while every three for *P. malariae*. *P. falciparum* can have recurrent fever every 36–48 hours or a less pronounced and almost continuous fever. For reasons that are poorly understood, but that may be related to high intracranial pressure, children with malaria frequently exhibit abnormal posturing, a sign indicating severe brain damage. Malaria has been found to cause cognitive impairments, especially in children. It causes widespread anemia during a period of rapid brain development and also direct brain damage. This neurologic damage results from cerebral malaria to which children are more vulnerable. Cerebral malaria is associated with retinal whitening, which may be a useful clinical sign in distinguishing malaria from other causes of fever.

Severe malaria is almost exclusively caused by *P. falciparum* infection, and usually arises 6–14 days after infection. Consequences of severe malaria

include coma and death if untreated—young children and pregnant women are especially vulnerable. Splenomegaly (enlarged spleen), severe headache, cerebral ischemia, hepatomegaly (enlarged liver), hypoglycemia and hemoglobinuria with renal failure may occur. Renal failure may cause black water fever, where hemoglobin from lysed red blood cells leaks into the urine. Severe malaria can progress extremely rapidly and cause death within hours or days. In the most severe cases of the disease, fatality rates can exceed 20%, even with intensive care and treatment. In endemic areas, treatment is often less satisfactory and the overall fatality rate for all cases of malaria can be as high as one in ten. Over the longer term, developmental impairments have been documented in children who have suffered episodes of severe malaria"

2.10 Diagnosis of Malaria

- **Blood smear** : Peripheral smear examination for malarial parasite is the gold-standard in confirming the diagnosis of malaria. Thick and thin smears prepared from the peripheral blood are used for the purpose.The peripheral blood smear provides comprehensive information on the species, the stages, and the density of parasitemia with a sensitivity of 5 to 10 parasites/µL of blood for an experienced laboratory professional.
- **Quantitative Buffy Coat (QBC) Test:** The QBC Test, developed by Becton and Dickenson Inc., is a new method for identifying the malarial parasite in the peripheral blood. It involves staining of the centrifuged and compressed red cell layer with acridine orange and its examination under UV light source. It is fast, easy and claimed to be more sensitive than the traditional thick smear examination.
- **Rapid Diagnosis of Malaria :** Although the peripheral blood smear examination that provides the most comprehensive information on a single test format has been the "gold standard" for the diagnosis of malaria, the immunochromatographic tests for the detection of malaria antigens, developed in the past decade, have opened a new and exciting avenue in malaria diagnosis. However, their role in the management and control of

malaria appears to be limited at present.Some types of rapid diagnosis of Malaria :

1. Immunochromatographic Tests for Malaria Antigens
2. Histidine-rich protein 2 of *P. falciparum* (PfHRP2)
3. *Plasmodium* aldolase
4. Parasite lactate dehydrogenase (pLDH)
5. The Rapid Malaria Tests: The RDTs have been developed in different test formats like the dipstick, strip, card, pad, well, or cassette; and the latter has provided a more satisfactory device for safety and manipulation. Example of RDTs (Para Sight F test , OptiMal Assay kit and OptiMal assay result) (Kakkilaya, 2006)

2.11 Treatment of Malaria

"Three main factors determine treatments: the infecting species of Plasmodium parasite, the clinical situation of the patient (for example, adult, child, or pregnant female with either mild or severe malaria), and the drug susceptibility of the infecting parasites. Drug susceptibility is determined by the geographic area where the infection was acquired. Different areas of the world have malaria types that are resistant to certain medications. The correct drugs for each type of malaria must be prescribed by a doctor who is familiar with malaria treatment protocols. Since people infected with *P. falciparum* malaria can die (often because of delayed treatment), immediate treatment for *P. falciparum* malaria is necessary.

Mild malaria can be treated with oral medication; severe malaria (one or more symptoms of either impaired consciousness/coma, severe anemia, renal failure, pulmonary edema,acute respiratory distress syndrome, shock, disseminated intravascular coagulation, spontaneous bleeding, acidosis,hemoglubinuia [hemoglobin in the urine], jaundice, repeated generalized convulsions, and/or parasitemia [parasites in the blood] of > 5%) requires intravenous (IV) drug treatment and fluids.

Drug treatment of malaria is not always easy. Chloroquine phosphate is the drug of choice for all malarial parasites except for chloroquine-resistant Plasmodium strains. Although almost all strains of *P. malariae* are susceptible to chloroquine, *P. falciparum*, *P. vivax* and even some *P. ovale* strains have been reported as resistant to chloroquine. Unfortunately, resistance is usually noted by drug-treatment failure in the individual patient. There are, however, multiple drug-treatment protocols for treatment of drug resistant Plasmodium strains (for example, quinine sulfate plus doxycycline [Vibramycin, Oracea, Adoxa, Atridox] or tetracycline [Achromycin], or clindamycin [Cleocin]).

There are specialized labs that can test the patient's parasites for resistance, but this is not done frequently. Consequently, treatment is usually based on the majority of Plasmodium species diagnosed and its general drug-resistance pattern for the country or world region where the patient became infested. For example, *P. falciparum* acquired in the Middle East countries is usually susceptible to chloroquine, but if acquired in sub-Sahara African countries, is usually resistant to chloroquine". (Davis, 2010).

2.12 Prevention of Malaria

Vector control is the primary public health intervention for reducing malaria transmission at the community level. It is the only intervention that can reduce malaria transmission from very high levels to close to zero. In high transmission areas, it can reduce child mortality rates and the prevalence of severe anaemia. For individuals personal protection against mosquito bites represents the first line of defence for malaria prevention.

"Two forms of vector control are effective in a wide range of circumstances. These are:

1. insecticide-treated mosquito nets (ITNs): Long lasting insecticide impregnated nets (LLINs) are the preferred form of insecticide treated nets for public health distribution programmes. WHO recommends universal

vector control coverage, and in most places, the most cost effective way to achieve this is through provision of LLINs, so that everyone in high transmission areas sleeps under a LLIN every night;

2. indoor spraying with residual insecticides: Indoor residual spraying (IRS) with insecticides is the most powerful way to rapidly reduce malaria transmission. Its full potential is realized when at least 80% of houses in targeted areas are sprayed. Indoor spraying is effective for 3–6 months, depending on the insecticide used and the type of surface on which it is sprayed. DDT can be effective for 9–12 months in some cases. Longer-lasting forms of IRS insecticides are under development" (WHO, 2010).

Drugs can also be used to prevent malaria. For travellers, malaria can be prevented through chemoprophylaxis, which suppresses the blood stage of malaria infections, thereby preventing malaria disease.

Insecticide resistance

Mosquito control is being strengthened in many areas, but there are significant challenges, including:

- An increasing mosquito resistance to insecticides, including DDT and pyrethroids, particularly in Africa; and
- Lack of alternative, cost-effective and safe insecticides.

The development of new, alternative insecticides is an expensive and long-term endeavour. Detection of insecticide resistance should be an essential component of all national malaria control efforts to ensure that the most effective vector control methods are being used. The choice of insecticide for IRS is a decision that should always be informed by local and recent data on the susceptibility of the target vectors, and ensuring the availability of such data is a shared responsibility.

2.13 The Global Strategy for malaria

"Malaria occurs in 109 countries around the world. A strategy combating malaria should be both country-led and internationally supported. *Individual countries* are often best positioned to know which actions are most appropriate depending on the populations at risk, the level of transmission, the degree to which interventions are in place, and the capacity of countries' health systems to take these efforts further. The international community, on the other hand, plays a critical role by supporting countries and providing tools. Through cooperation, countries and international partners can achieve the near-term goals of mortality and morbidity reduction by 2010 and 2015 as well as the longer-term vision of worldwide eradication. Three Components of the Global Strategy: Control, Elimination and Research

2.13.1 Control

The majority of malaria-endemic countries can make a substantial impact on their malaria burden by controlling it with existing tools. By first scaling up appropriate interventions for all populations at risk and then sustaining control over time, malaria will cease to be a major source of deaths world-wide.

2.13.2 Elimination

Reducing to zero all locally-acquired infections within a country will bring the world closer to the ambitious goal of global eradication. Some countries are currently engaging in elimination and more will transition to elimination after achieving control provided there is strong rationale for this move. In high transmission settings, complete interruption of malaria transmission will require additional, new control tools.

2.13.3 Research

Malaria control and elimination efforts will require continued research to be successful. International research is needed to create new tools, as well as inform policy and improve operational implementation of strategies. Then, national and local health systems must focus on how to use the tools and sustain the gains" (RBM, 2010).

Malaria disproportionately affects poor people who cannot afford treatment or have limited access to health care, trapping families and communities in a downward spiral of poverty. (WHO, 2010)

Key tools for malaria prevention and treatment: (RBM 2009)

1. **Long-lasting insecticidal nets (LLINs):** Sleeping under insecticide-treated nets to prevent infectious mosquito bites
2. **Indoor Residual Spraying (IRS):** indoor application of long-lasting chemical insecticides to kill Malarious mosquitoes.
3. **Intermittent Preventive Treatment during pregnancy (IPTp):** in which pregnant women, who are at increased risk for malaria infection, illness and death, receive regular preventative treatment during their pregnancies.
4. **Other vector (mosquito) controls:** including larvaciding and environmental management
5. **Diagnosis:** prompt parasitological diagnosis by microscopy or rapid diagnostic tests (RDTs).
6. **Treatment:** prompt provision of antimalarial drugs (ACTs for P. falciparum and Chloroquine and primaquine for *P. vivax*).

2.14 Economic impact of malaria

Malaria causes significant economic losses, and can decrease gross domestic product (GDP) by as much as 1.3% in countries with high levels of

transmission. Over the long term, these aggregated annual losses have resulted in substantial differences in GDP between countries with and without malaria, particularly in Africa.

The health costs of malaria include both personal and public expenditures on prevention and treatment. In some heavy-burden countries, the disease accounts for (WHO, 2010):

- up to 40% of public health expenditures;
- 30% to 50% of inpatient hospital admissions;
- up to 60% of outpatient health clinic visits.

2.15 MDG indicators and malaria

More focus on Malaria prevention and control could help the national health system to achieve MDGs. All six of these MDGs are impacted by the malaria burden (Benjamin, 2010)

MDG 1 - *Eradicate extreme poverty*: Malaria contributes to approximately 1 percent of gross domestic product (GDP) loss. It also accounts for 40 percent of health spending and 30 percent of household health expenditures in endemic countries.

MDG2 – *Achieve universal education*: Malaria contributes to absenteeism in Africa. Cognitive damage from cerebral malaria prevents many children from attending schools.

MDG 4- *Reduce childhood mortality*: Malaria is one of the leading causes of childhood death worldwide.

MDG 5- *Improve maternal health*: Pregnant women are at increased risk for contracting malaria because of their immune-compromised status. Malaria also contributes to maternal anemia, which can lead to hemorrhage, spontaneous abortion, neonatal death and low-birth weight.

MDG 6- *Combat HIV/AIDS, malaria and other diseases*: The Global Malaria Action Plan calls for several actionable targets to achieve malaria elimination.

MDG 8- *Develop global partnerships*: Malaria has benefited from assistance of private-public partnerships to improve access to affordable malaria interventions.

2.16 Bed nets and Malaria

Bed nets are one of the best vector control intervention and key tool for malaria prevention in endemic area. Bed net is general term to represent the specific recommended types of mosquito nets such as ITNs (Insecticides-treated Mosquito Net s) and LLINs (long-lasting insecticidal nets). "The WHO Global Malaria Program (WHO/GMP) recommends the following three primary interventions for effective malaria control, which must be scaled up if countries are to move towards achieving the United Nations Millennium Development Goals* by 2015:

- Diagnosis of malaria cases and treatment with effective medicines;
- Distribution of insecticide-treated nets (ITNs), more specifically long-lasting insecticidal nets (LLINs), to achieve full coverage of populations at risk of malaria; and
- Indoor residual spraying (IRS) to reduce and eliminate malaria transmission.

This Position Statement reviews the evidence and experiences to date on ITNs, describes the current WHO/GMP position on ITNs, including LLINs, for prevention and control of malaria, and outlines additional research needs (WHO, 2007)

ITNs and LLINs: As before mentioned ITN and LLIN are the best available type of anti mosquito nets as a best tool for prevention of Malaria in endemic countries.

"An ***insecticide-treated net (ITN)*** 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:

1. 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.

2. A ***long-lasting insecticidal net (LLIN)*** is a factory-treated mosquito net made with netting material that has insecticide incorporated within or bound around the fibers. 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" (WHO, 2007)

2.17 Strategies for scaling-up ITN coverage through the use of LLINs

A. In endemic areas with intense malaria transmission (stable malaria)

1. All pregnant women in the LLIN target population should receive an LLIN as early as possible in pregnancy. Each pregnant woman should be educated about using the LLIN for herself and, if possible, one other person. After delivery, and until the child has its own LLIN, that second person should be the newborn/infant.

2. All infants should receive at least one LLIN. An infant whose mother has not received an LLIN during pregnancy should receive one at the first EPI consultation. In addition, all infants should receive an LLIN when they have completed their vaccination schedule, normally with measles vaccination at 9 months. However, in countries with high measles and low DTP3 coverage rates, the LLIN may be delivered at DTP3 as an incentive. The parent or carer should be taught that the LLIN is to be used by the infant plus one additional person (who may be the mother or another relative but should preferably be another young child).

3. Measles vaccination campaigns, especially follow-up campaigns, should be used as much as possible to deliver LLINs to children less than 5 years

of age in areas where coverage rates are low. If possible, one LLIN should be given to each child (but not more than two per carer).

4. Other activities that target, for example, remote and underserved populations or people living in complex emergency situations may be used for combined health interventions, including LLINs. The target group may be young children, children and pregnant women, or everybody (at a ratio of 1 LLIN per 2 persons), depending on the conditions. Problems of access may make full population coverage "in one go" more efficient than targeting, but issues of financial resources, logistics, education and follow-up need to be carefully reviewed and planned.

5. If malaria in people with HIV/AIDS is a major problem, the possibility of providing LLINs through services targeting these people should be explored. Although antenatal care and immunization programs target specific groups, the use of LLINs makes it possible to achieve full population coverage through these channels in 4 years if LLINs with a useful life of 5 years are used.

B. In endemic areas with low malaria transmission

LLINs should be delivered to all people (1 LLIN per 2 persons) within a short period and should focus initially on priority target areas selected on the basis of:

1. higher burden of malaria within areas targeted for LLIN implementation (And if practicable),
2. Limited access to health services.

Phased expansion to protect all target populations in the remaining areas should be undertaken as resources and capacity improve" (WHO, 2007).

2.18 Bed net surveys

2.18.1 Surveys in Afghanistan

Scarcity of health system researches and limitation of valid epidemiological data was one of the main problems for evidence-based decision making and planning in the early Past-Taliban period. The National Malaria and Leishmaniasis Program of Ministry of Public Health together with the international institutions and MoPH stakeholders conducted a number of malaria researches and surveys. Although the number of these surveys are rare, but could be the best source of epidemiological data.

A study of the Home Based Management of Malaria through the BDN (Basic Development Needs) program in North-East (Kunduz) and Eastern (Nangarhar) regions of Afghanistan was carried out by NMLCP, Ministry of Public Health, WHO Representative Office and London School of Hygiene and Tropical Medicine / Health Protection and Research Organization. The result shows that ITN coverage increased to almost universal coverage in the intervention village, with household coverage increasing to 93% and >98% of households reporting that all members used the ITN. Baseline coverage was comparable in control and intervention villages at ~60%. Awareness of disease appeared to improve in intervention villages. Use of ITNs was improved, and this is an important contributor to the reduction in falciparum malaria". (Toby Leslie et al, 2007).

A case-control study was conducted at 8 health facilities in Nangarhar and Laghman provinces. A total of 1212 women were enrolled in the survey. A total of 284 (23.5%) were pregnant, and 143 (11.8%) were defined as cases. Use of insecticide treated bed nets (ITN) were negatively associated with malaria risk (OR 0.48, 95%CI 0.30-0.75) (Toby Leslie et al, 2004).

A cross-sectional prevalence, knowledge, attitudes and practices (KAP) survey was conducted in four districts (Shinwar, Momandara, Batikot, and Nazian) in Nangarhar province in the eastern region of Afghanistan. Amongst the households who had an ITN, 33% and 32% reported that everybody or specifically, children usually sleep under the ITN respectively. However, when

asked whether they had used an ITN last night, only 26% reported that they had. Most said that they had not because they were not bothered by insects, or that someone else was using it. Although the knowledge that ITNs prevent malaria is evident in this study group, only 17% reported this as the major advantage of using an ITN. Amongst those households who do not own an ITN, 95% reported that this was because ITNs are too expensive, 4% reported that they were not available. None reported that ITNs were either uncomfortable or not useful" (Toby Leslie et al , 2004).

Only 38% observed the connection between mosquitoes and malaria in the KAP survey conducted by HNI (North: 19% and East: 48%). With 79% reporting that Insecticide Treated Nets (ITNs) were a good form of protection against mosquitoes and 70% reported that ITNs were the best way to protect against malaria but more men than women displayed this knowledge. The study found not all ITN owners (63%) used their ITNs the previous night (54%- of those who owned an ITN). The main deterring factors from owning an ITN were cost (~ 60%) and ITNs being inaccessible. People were reported to be paying between $3.50 and $4.00 (subsidized price) for their ITNs. People found the price of ITNs to be (NMLCP, 2008)

Another survey was conducted during Taliban in eastern Afghanistan. This study examined reported ITN purchasing, coverage, and usage in eastern Afghanistan and explores women's access to health information during the Taliban regime (1996-2001). Based on the result of the study Malaria knowledge was similar among men and women and ITN owners and non-owners. Widow-led and landless households reported most difficulties purchasing ITNs. Most participants wanted to buy ITNs only if they could cover all household members. When not possible, preferential usage was given to women and children. (Howard, 2000)

2.18.2 Bed net surveys in other countries

A nationally representative malaria indicator survey (MIS) was conducted in Ethiopia between September and December 2007 to determine parasite and anemia prevalence in the population at risk and to assess coverage, use and access to scaled-up malaria prevention and control interventions. The survey used a two-stage random cluster sample of 7,621 households in 319 census enumeration areas. According to this survey, a total of 32,380 people participated in the survey. Of 5,083 surveyed households, 3,282 (65.6%) owned at least one ITN. In ITN-owning households, 53.2% of all persons had slept under an ITN the prior night, including 1,564/ 2,496 (60.1%) children <5 years of age, 1,891/3,009 (60.9%) of women 15 - 49 years of age, and 166/266 (65.7%) of pregnant women (Jima, 2007).

In order to identify independent predictors for bed net use, respondents from 643 households selected randomly from 21 clusters were interviewed in Mbarara municipality, Uganda. The factors that favor bed net use are being _ 30 years of age, ownership of television, having mosquito nets in ventilators of the house, respondent or respondent's spouse being a skilled worker, professional, or owning major business, living in a permanent house, believing that bed nets prevent malaria, believing that bed nets are worth their cost, not believing that convulsions cannot be cured by modern medicine, and believing that bed nets are not expensive. These 10 variables predicted bed net use, with 293 (82%) of 356 of bed net users correctly classified and 205 (71%) of 287 of the nonusers being correctly classified. Overall, 498 (77%) of 643 of the households were correctly classified. This classification was significantly different from that observed by chance (_2 log likelihood ratio 64, 632 degrees of freedom [df] and significance 0.39; model chi-square 243, 10 df and significance _ 0.001; and goodness of fit 639, 632 df and significance 0.43). The strongest predictors of bed net use are living in a permanent house and agreeing that bed nets are worth their cost, with adjusted odds ratios of 4.29 and 3.93, respectively. The strongest predictors of bed net use were living in a permanent house and agreeing that bed nets are worth their cost, with adjusted odds ratios of 4.29 (95% confidence interval, 2.76–6.71)

and 3.93 (95% confidence interval, 2.5–26.13), respectively. These data suggest that in order to increase the use of bed nets, the price of bed nets needs to be reduced and educational messages that stress the favorable use of bed nets need to be increased Because indicators of high socioeconomic status influenced bed net use, there is a need to reduce the price of bed nets so they are affordable by members of lower socioeconomic classes. (NUWAHA, 2001).

In an ethnographic household survey in four study villages which were purposefully selected to represent socio-economic and geographical diversity in central Kenya, 400 households were randomly selected from the four study villages. "Factors which significantly caused variation in bed net use were occupant relationship to household head (χ^2 = 105.705; df 14; P = 0.000), Age (χ^2 = 74.483; df 14; P = 0.000), village (χ^2 = 150.325; df 6; P = 0.000), occupation (χ^2 = 7.955; df 3; P = 0.047), gender (χ^2 = 4.254; df 1; P = 0.039) and education levels of the household head or spouse (χ^2 = 33.622; df 6; P = 0.000). The same variables determined access and conditions of bed nets at household level. Protection against mosquito bite (95%) was the main reason cited for using bed nets in most households while protection against malaria came second (54%)" (Peter et al, 2009).

In another study to assess the behavioral and socio-economic factors associated with avoiding mosquitoes and preventing malaria in urban environments in Kenya. "Data from two cities in Kenya were gathered using a household survey and a two-stage cluster sample design. The cities were stratified based on planning and drainage observed across the urban areas. Individual interviews given to each household included questions on socio-economic status, education, housing type, water source, rubbish disposal, mosquito-prevention practices and knowledge of mosquitoes. The analysis shows that people from wealthier, more educated households were more likely to sleep under a net, in Kisumu (OR = 6.88; 95% CI = 2.56, 18.49) and Malindi (OR = 3.80; 95% CI = 1.91, 7.55). Similarly, the probability that households use several mosquito-prevention activities was highest among the wealthiest, best-educated households in Kisumu (OR = 5.15; 95% CI = 2.04, 12.98), while in Malindi household wealth alone is the major determinant" (Macintyre et al 2002)

2.19 Afghanistan profile

2.19.1 Geography and location

Afghanistan is a land-locked country located in the Southern Asia with a total of 652,230 sq km area. The country has 5,529 km land boundary with six countries (China 76 km, Iran 936 km, Pakistan 2,430 km, Tajikistan 1,206 km, Turkmenistan 744 km, Uzbekistan 137 km). There are 34 provinces with 398 districts and around 32509 villages (According to the latest civil division by Ministry of Interior affairs). Around two thirds of its surface is covered by mountains. The huge Hindu Kush mountains form a barrier between the northern provinces and the rest of the country .This mountain range has also divided Afghanistan into three very different geographic regions (The central highlands , the Northern plains which is the most fertile region of the country and the Southern Plateau)

2.19.2 Socio – economic characteristics

Over 35 years of war, Afghanistan has been faced to extreme poverty, political instability, impaired infrastructure and large gender disparities "Afghanistan, with a per-capita income of less than US$ 570, is among the least developed countries in the world with 70% of the population living in extreme poverty and health vulnerability.

The social indicators, which were low even before the 1979 Soviet invasion, rank at or near the bottom among developing countries, preventing the fulfillment of rights to health, education, food and housing. Since the fall of the Taliban almost five years ago, important progress has been achieved in all sectors, but much remains to be done in order to reach a significantly strengthened social infrastructure, realize the rights to survival, livelihood, protection and participation, and reach the Millennium Development Goals (MDGs)." (WHO, April 2009)

The 2009 Human Development Index of the United Nations ranks Afghanistan at 181 of 182 countries. According to this year's HDI (which refers to 2007), HDI for Afghanistan is 0.352. (UNDP, 2007)

Table 3 Afghanistan's Human Development Index (UNDP, 2007)

HDI value	Life expectancy at birth (years)	Adult literacy rate (% ages 15 and above)	Combined gross enrolment ratio (%)	GDP per capita (PPP US$)
1. Norway (0.971)	1. Japan (82.7)	1. Georgia (100.0)	1. Australia (114.2)	1.Liechtenstein (85,382)
181. Afghanistan (0.352)	176. Afghanistan (43.6)	150. Afghanistan (28.0)	156. Afghanistan (50.1)	164. Afghanistan (1,054)

According to the latest data from World Bank 42% of population lives below the national poverty line .The World Bank ranks Afghanistan at 120 out of 191 countries based on GDP (Gross Domestic Product). According to the WB, Afghanistan has the GDP of US$10.6 billion (10,624 Millions) and the Gross National Income or GNI of US$10.6 billion (10,603 Millions) in 2008. (WB, 19 April 2010)

2.19.3 Education

A large number of people in Afghanistan have been deprived of education and have no access to basic learning mainly due to insecurity, poverty, civil unrest and social - cultural barriers. One of the main vulnerable groups is women and girls. Illiteracy rate significantly differs between women and men and between urban and rural areas. Even between provinces, clear disparities have been observed because of inter-tribal conservative rules and regulations. The numbers of schools are insufficient especially for the girls. Shortage of qualified teachers, particularly women is another issue exacerbating the situations.

The quality of education is very poor. “Average adult illiteracy rate is 71% [female illiteracy as high as 86%]. More than 1 million primary school age

girls not in school [in two provinces, girls' nonenrolmen = 99%] . 4.89 million children enrolled in schools with 4.25 millions in primary grades of 1-6. (About 402,427 new girls -100.03% gross enrolment of primary school entry)" (UINCEF, 2007) Despite the insecurity, poverty and other socio-cultural barriers, the demand for education after the fall of the Taliban has continuously exceeded expectations. More than 6.2 million students attend Grades 1-12 today, the largest figure in the history of Afghanistan. Approximately 2.2 million students are girls – Female participation has exceeded the pre-Taliban period (World Bank, 2010).

2.19.4 Health status and demographical characteristics

Although significant improvements have been observed in the health status of people after the fall of Taliban, health status of the Afghan people is still among the worst in the world. People suffer from many types of diseases, malnutrition and poverty. The majority of the population lacks access to safe drinking water and sanitary facilities. Afghanistan is currently faced with the following key health problem: (WHO, 2006)

- High level of infants mortality rate
- High level of under 5 mortality rate
- One of the world's highest maternal mortality ratio
- Elevated level of malnutrition and anemia
- High incidence of communicable diseases (TB and Malaria)
- Mental health problems and disability

A summary of the main national health and demographic indictors is given in next table. The table shows the recent fact and figures, cited from most reliable international sources. Validity of health –related data in Afghanistan is a matter of concern, mostly because of scarcity of health surveys and researches. Persisting insecurity is one of the leading causes preventing the national public health workers, concerned international and national health – related agencies to conduct such kind of informative and descriptive studies.

Table 4 Health and Demographic Indicators of Afghanistan

Indicators	Value	Year	Source
Total population (Figure per 000)	23993.5	2009	CSO
Population growth rate	2.4	2008	UNDP
life expectancy at birth (years)	44	2008	UNICEF
Total adult literacy rate (%)	28	2008	UNICEF
Crude birth rate (per 1000 population)	47	2008	UNICEF
Crude death rate (per 1000 population)	29	2008	UNICEF
Total fertility rate (per women)	6.6	2008	UNICEF
Maternal Mortality Ratio (100,000 live births)	1600	2008	UNICEF
Under -5 mortality rate (per 100 live births)	257	2008	UNICEF
Infant mortality rate (per 100 live births)	165	2008	UNICEF
DPT3 vaccination rate (%)	85	2008	UNICEF
Measles vaccination rate (%)	75	2008	UNICEF
Polio vaccination rate (%)	85	2008	UNICEF
Polio laboratory confirmed cases	31	2008	UNICEF
HIV prevalence adult (%)	0.01	2000	UNAIDS
Estimated number of Tuberculosis cases	51546	2009	WHO
Population at risk for Malaria (Million)	14.5	2009	NMLCP
Number of beds per ten thousand person	5	2009	CSO
% of population using improved drinking water	22	2006	UNICEF

2.19.5 Health system in Afghanistan

There are different ideas and interpretation about the content of health system. Some people defines health system as only the public health care services , available at the national level and implemented by the governments . If we focus on the wider definition, the health system of a country encompasses both, the public and private health care services:

2.19.5.1 Public Health Care System in Afghanistan

The inherited health services from Taliban at the end of 2001 were very limited in quality, capacity and coverage. After 2001 and by the beginning of new Interim Government the Afghanistan government with the help of international community's started to re-establish the health system gradually. During the 2002 – 2004, Ministry of Public Health (MoPH) had extraordinary post-conflict progress and achievements. Many policies and strategies to guide and facilitate the health system development have been established.

In the immediate post-conflict period, Ministry of Public Health has been adopted the following six key strategies as a short –term solution and approach (MoPH, 2006):

1. Stewardship
2. Establishing Priorities and Developing Strategies
3. Contracting
4. Evidence-based Decision-making
5. Coordination
6. Donor Financial and Technical Support

In the past 9 years, the Ministry of Public Health has been established a stewardship role while delegating health service delivery to the private sector (NGOs) within clear and manageable policies such as Basic Package of Health Services(BPHS) and Essential Package of Hospital Services(EPHS). The intervention of three major donors (USAID, European Commission & the World Bank) is coordinated successfully in the form of the aforementioned policy documents and other standard health packages.

Types of Interventions and Health Facilities Used by the BPHS

BPHS has six standard types of health facilities, ranging from community outreach provided by Community Health Workers (CHWs) at health posts, through outpatient care at health sub centers and basic health centers and provided

by mobile health teams, to inpatient services at comprehensive health centers and district hospitals. The following table summarizes the seven elements of the BPOHS along with their components:

Table 5 The seven elements of the BPHS and their components

1. Maternal and Newborn Care	1. Antenatal care 2. Delivery care 3. Postpartum care 4. Family planning 5. Care of the newborn
2. Child Health and Immunization	1. Expanded Program on Immunization (EPI) 2.Integrated Management of Childhood Illness
3. Public Nutrition	1. Prevention of malnutrition 2. Assessment of malnutrition
4. Communicable Disease Treatment and Control	1. Control of tuberculosis 2. ***Control of malaria*** 3. Prevention of HIV and AIDS
5. Mental Health	1. Mental health education and awareness 2. Case identification and treatment
6. Disability and Physical Rehabilitation Services	1. Disability awareness, prevention, and education 2. Provision of physical rehabilitation services 3. Case identification, referral and follow-up
7. Regular Supply of Essential Drugs	1. Listing of all essential drugs needed

Types of Health Facilities Used by the EPHS: (MoPH 2005)

1. **District Hospital (DH):** Each district hospital will have from 30 to 75 beds and serve a population of 100,000 to 300,000, covering from one to four districts. The basic
2. **Provincial Hospital (PH):** A provincial hospital serves a province and will have from 100 to 200 beds.
3. **Regional Hospital (RH):** A regional hospital serves several provinces and will have from 200 to 400 beds.

2.19.5.2 Private Health Sector in Afghanistan

Similar to other developing countries the private sector has many components in Afghanistan:

- Non-governmental organizations (NGOs). Currently the NGOs are the main BPHS and EPHS implementers in Afghanistan based on Ministry of Public Health strategies and sub contracting approaches.
- Medical practice by private hospitals and clinics. Within past five years the number of private hospitals and clinics has been increased and still is growing up.
- Medical practice by doctors, nurses, or by some mid level health workers who provide injections and drugs.
- The pharmaceutical sectors (Licensed or unlicensed sellers)
- The non-biomedical healers (Unani, homoeopathic, chiropractic and etc.)
- Traditional medicine (Traditional birth attendance, herbalists and some of the religious people who believe about the supra natural cause of diseases).

2.19.6 Cultural Characteristics

Afghanistan is a multi-ethnic, multi-cultural and multi –lingual country. "Different regions of the country have their own unique traditions and cultures. The country consists of the flowing ethnic groups: Pashtun 42%, Tajik 27%, Hazara 9%, Uzbek 9%, Aimak 4%, Turkmen 3%, and Baloch 2%, other 4%. Around 99% of people in Afghanistan is an Islamic country (Sunni Muslim 80%, Shia Muslim 19%, other 1%). The languages in this country are: Persian or Dari (official) 50%, Pashto (official) 35%, Turkic languages (primarily Uzbek and Turkmen) 11%, 30 minor languages (primarily Balochi and Pashai) 4%, much bilingualism". (Agency 2010)

2.19.7 Introduction of Badakhshan Province

Badakhshan is a North -Eastern province of Afghanistan, consist of 28 districts with total population of 823,000(2006).It is a mountainous province having a monotypic climate with hard and prolonged winters. Badakhshan has very remote and hard to access districts. As a result of these characters, the blockage of roads during winters is a common event in some districts . Badakhshan is a well-Known province by having lots of male and female schools, training institutes (Midwifery and nursing) and other educational institutes. The people of this province are patron of education and culture. The people are mainly busy with husbandry and farming in the rural areas while trading is the main source of income in the cities. The security situation is good in Badakhshan and no significant incident reported recently.The health service delivery is subcontracted to the international and national NGOs . The NGOs implement the basic package of health services (BPHS) and essential package of health services (EPHS) through around 62 health facilities. The health project in this province is funded by USAID and World Bank.

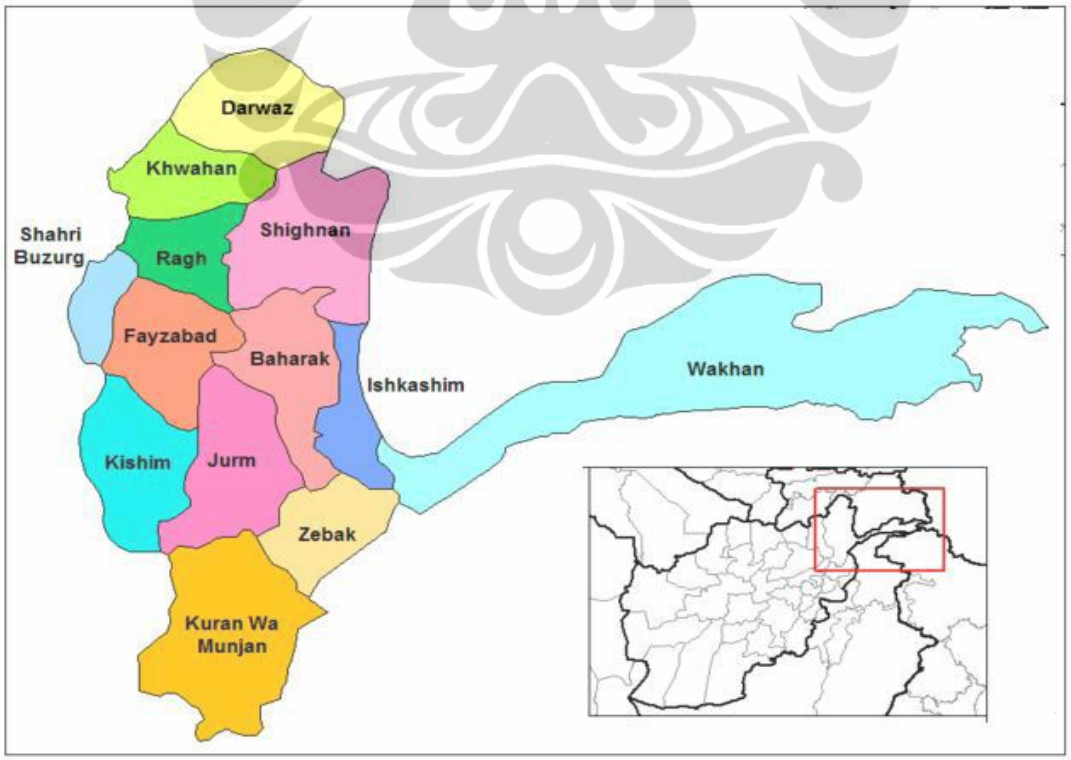

Figure 4 Map of Badakhshan province _ Afghanistan

Badakhshan is bordered with Tajikistan in the north , China in the east and Pakistan in the sought .Badakhshan was a stopover on the ancient Silk Road trading path. It consists of 29 districts. Fayzabad is the province's capital with a population of nearly 50,000 (Randa et al, 2008). It is located in the north-east of the country between the Hindu Kush and the Amu Darya. The province has a total area of 44,059 km², most of which is occupied by the Hindu Kush and Pamir mountain ranges. Badakhshan. border with China.

2.20 Health Belief Model

Theory Summary:"Two major factors influence the likelihood that a person will adopt a recommended preventive health action. (Fishbein et al, 1998).

- First they must feel personally threatened by the disease i.e. they must feel personally susceptible to a disease with serious or severe consequences .
- Second they must believe that the benefits of taking the preventive action outweigh the perceived barriers to (and/or costs of) preventive action"

Health Belief Model (Detailed)

"The Health Belief Model (HBM) is a psychological model that attempts to explain and predict health behaviors by focusing on the attitudes and beliefs of individuals. The HBM was developed in the 1950s as part of an effort by social psychologists in the United States Public Health Service to explain the lack of public participation in health screening and prevention programs (e.g., a free and conveniently located tuberculosis screening project). Since then, the HBM has been adapted to explore a variety of long- and short-term health behaviors. The key variables of the HBM are as follows: (Glanz et al 2002)

1. **Perceived Threat:** Consists of two parts: perceived susceptibility and perceived severity of a health condition.
   - **Perceived Susceptibility:** One's subjective perception of the risk of contracting a health condition,
   - **Perceived Severity:** Feelings concerning the seriousness of contracting an illness or of leaving it untreated (including evaluations of both medical and clinical consequences and possible social consequences).
2. **Perceived Benefits:** The believed effectiveness of strategies designed to reduce the threat of illness.
3. **Perceived Barriers:** The potential negative consequences that may result from taking particular health actions, including physical, psychological, and financial demands.
   - **Cues to Action:** Events, either bodily (e.g., physical symptoms of a health condition) or environmental (e.g., media publicity) that motivate people to take action. Cues to actions are an aspect of the HBM that has not been systematically studied.
4. **Other Variables:** Diverse demographic, socio-psychological, and structural variables that affect an individual's perceptions and thus indirectly influence health-related behavior." (Service, 2008)

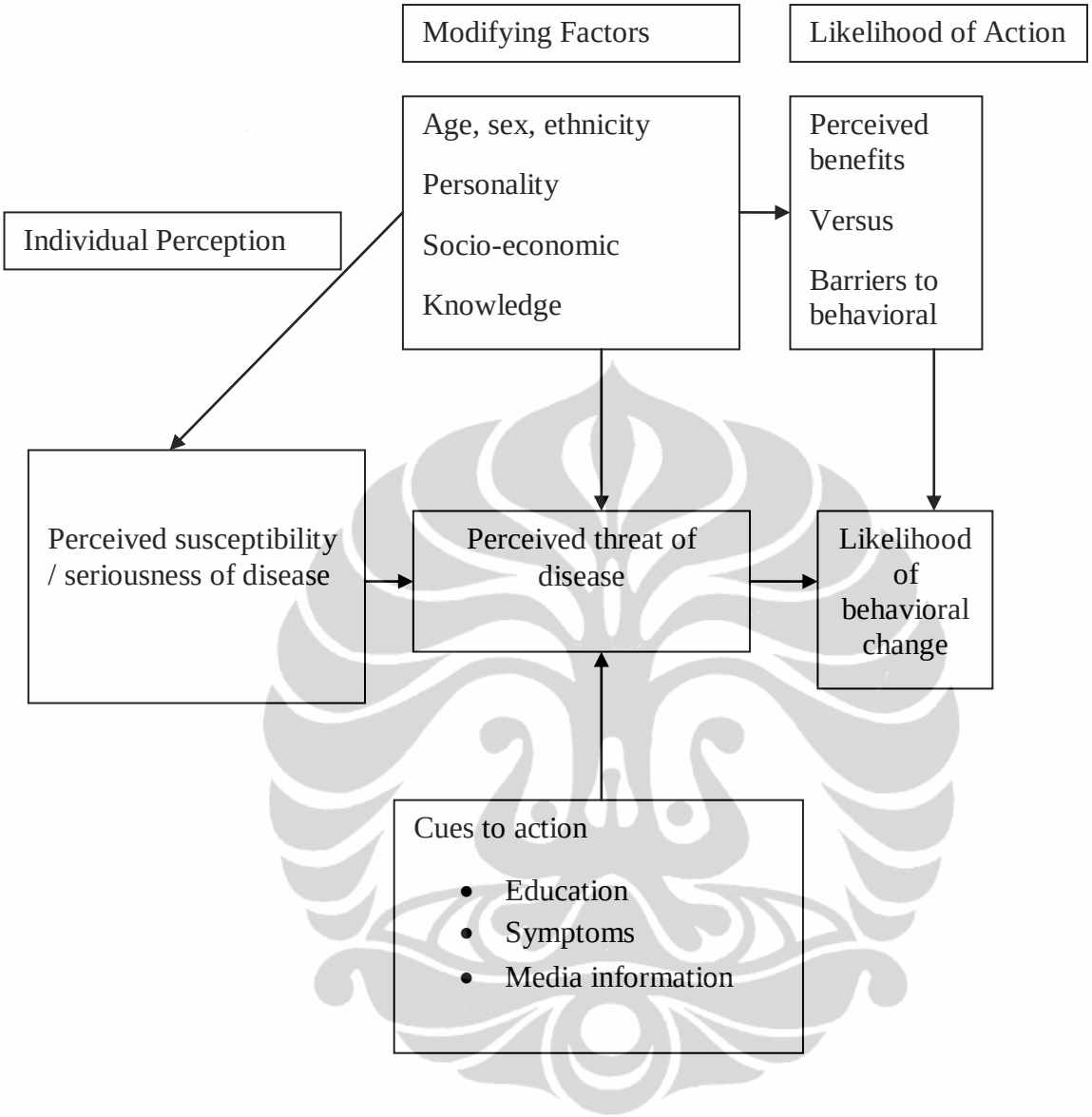

Figure 5 The visual framework of Health Believe Model

Source: (Glanz et al, 2002, p52_ http://www.utwente.nl/cw/theorieenoverzicht/Theory%20clusters/Health%20Communication/Health_Belief_Model.doc/index.html)

CHAPTER III
THEORITICAL AND CONCEPTUAL FRAMEWORKS

3.1 Theoretical Framework

Theories are constructed in order to explain and predict some phenomena (e.g. relationships, events, or the behavior). A theory makes generalizations about observations and contains set of ideas and models which are interrelated and coherent with each other. Many theories can be used as sources for the theoretical framework.

The theoretical framework of this study is designed based on the most commonly used theory in health education and health promotion, The Health Believe Model (HBM) (Glanz et al 2002). According this theory "Two major factors influence the likelihood that a person will adopt a recommended preventive health action:

- First they must feel personally threatened by the disease i.e. they must feel personally susceptible to a disease with serious or severe consequences

- Second they must believe that the benefits of taking the preventive action outweigh the perceived barriers to (and/or costs of) preventive action" (Fishbein et al, 1998).

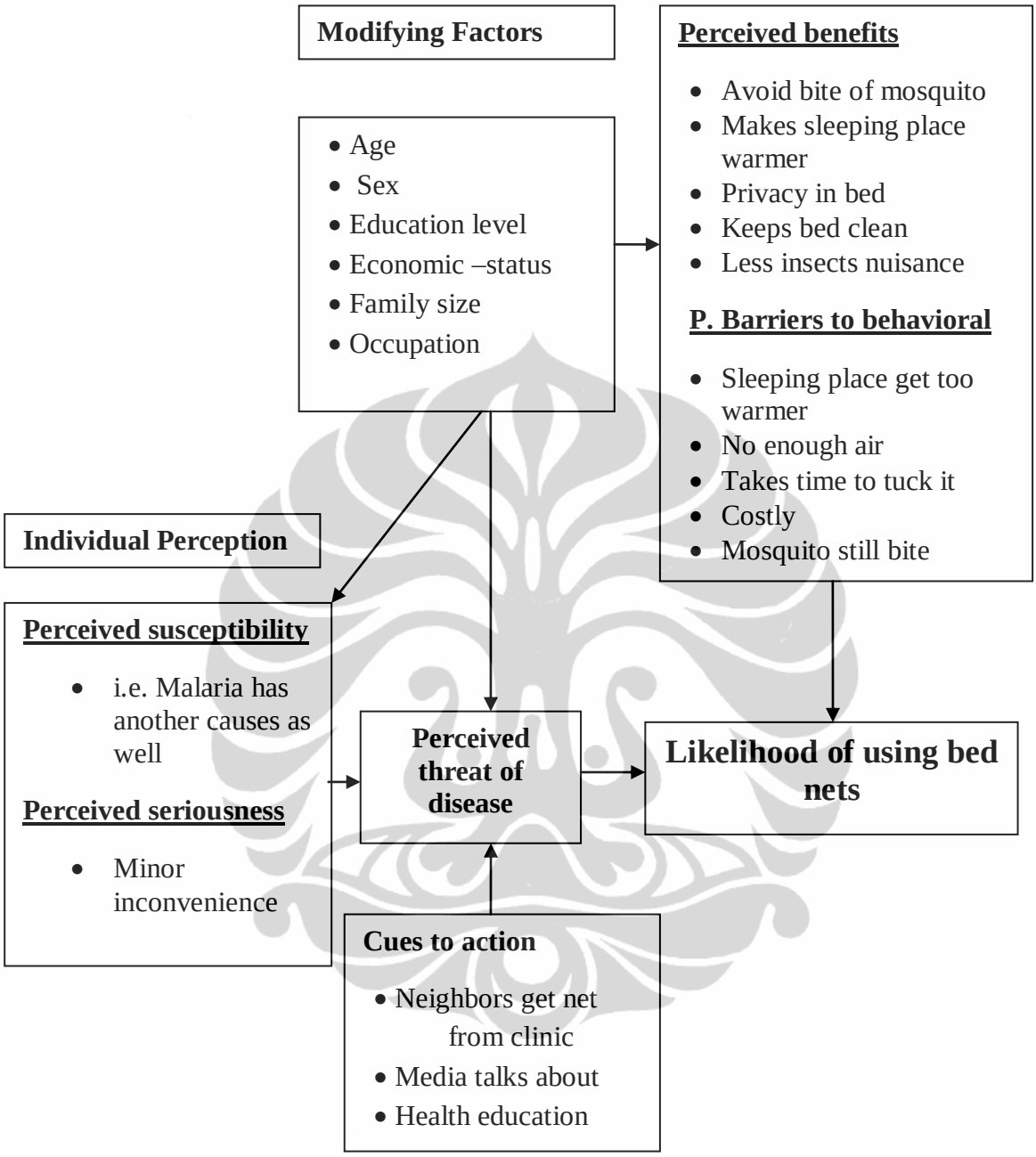

Figure 6 The theoretical framework for this study modified from HBM

3.2 Conceptual Framework

The conceptual framework is the diagram of proposed causal linkages among a set of concepts believe to be related to a particular public health problem/intervention. The following conceptual schema shows the anticipated concepts as independent variables, the process or links and the outcome variable or the event under the study.

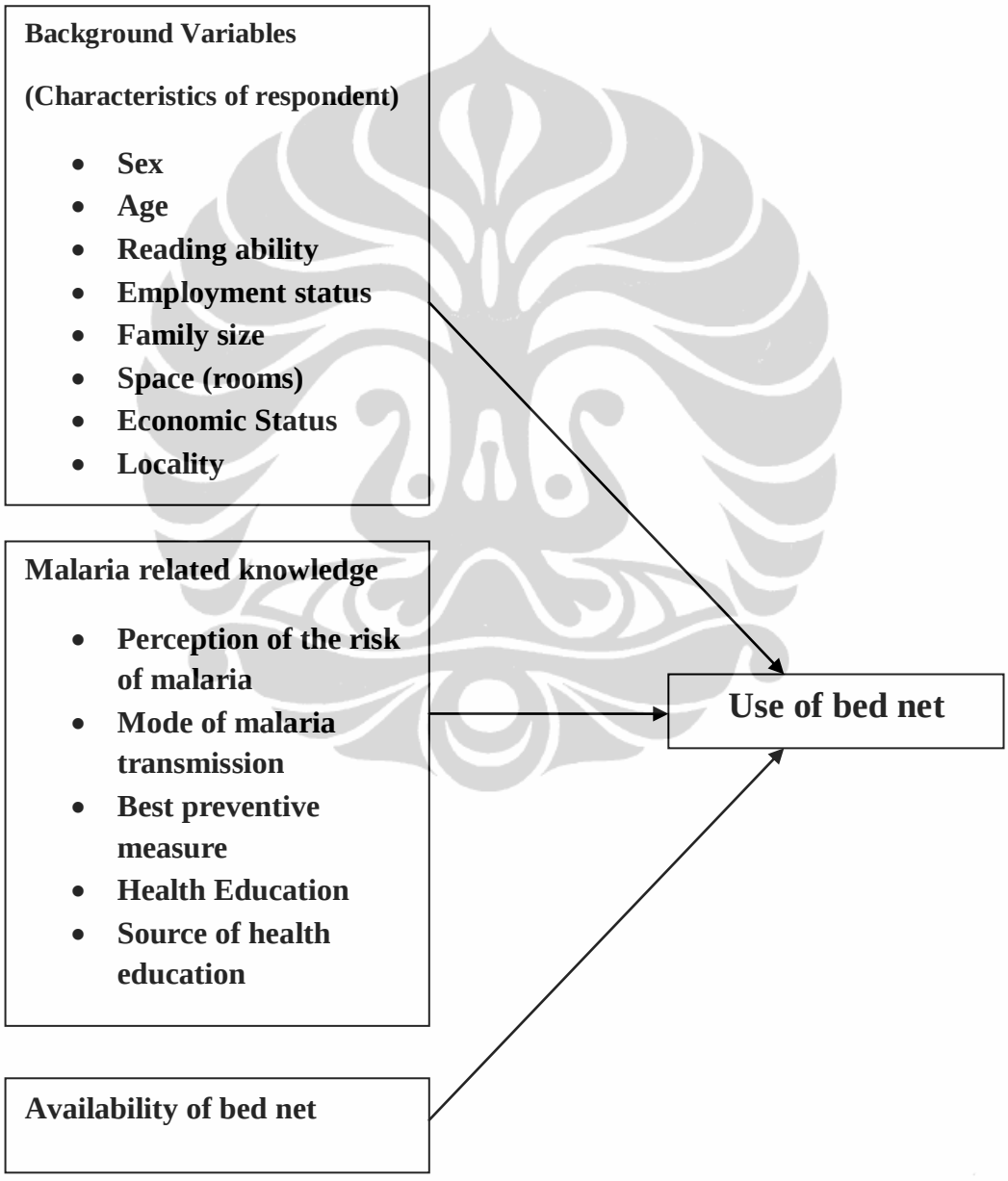

Figure 7 The conceptual framework of this study

3.3 Operational definition of the variables

In this step, the conceptual definitions of the variables are changed into the operational definitions or indicators. The purpose of operationalzing the variable is to make them measurable.

Table 6 The operational definition of the variables

Definition of the Variable	Operational Definition	Category	Scale
Dependent (Outcome) Variable			
Use of bed net	Head of household reported the habit of sleeping under the net at the last night of the survey	Ordinal	0. No 1. Yes
Independent Variables			
Sex	Gender of head of household	Nominal	1. Male 2. Female
Age	Age of head of household at last birthday	Ordinal	1. Age=<45 y 2. Age >45 y
Reading ability	Ability of the head of household to read and write	Nominal	0. No 1. Yes
Employment status	Employment status of the head of household whether he/she is employed or has a paid job.	Nominal	1. Yes 2. No
Family size	Number of family members (male and female of all ages permanently living within a household)	Ordinal	1. =<7 2. >7
Number of rooms	The number of rooms or quarters in the household	Ordinal	0. >4 1. =<4

Definition of the Variable	Operational Definition	Category	Scale
Economic status	Economic status of the household whether they possess :(Electricity, radio, TV, telephone , refrigerator, fan, air conditioner, bicycle, motorcycle and car.)	Ordinal	1. High 0. Low
Locality of the household	Residential area of the household according to defined division (Urban and rural)	Nominal	1. Urban 2. Rural
Perception of the risk of malaria	Perception of head of the household whether they are living in areas where malaria is a risk (High or low)	Ordinal	0. Don't know 1. Know
Mode of malaria transmission	Knowledge of head of household to recognize that malaria is transmitted by mosquito bite	Ordinal	0. Don't know 1. Know
Best preventive measure	Knowledge of head of household to know that bet net is the best preventive measure	Ordinal	0. Don't know 1. Know
Health education	Exposure of the head of household to malaria health education	Nominal	1. No 2. Yes
Source of health education	The source of health education whether from Health Facility or others (TV, radio, newspaper, masjid, family and friends).	Nominal	0. Didn't receive 1. Health Facility 2. Others
Bed net availability	Does the family possess bed net	Nominal	1. No 2. Yes

3.4 Hypothesis

1. There is an association between the background characteristics of the respondents and the use of bed nets. (Such as sex, age, reading ability, employment status, family size, number of rooms, economic status and locality of the household).

2. There is an association between malaria related health knowledge of the respondents and bed nets usage.

3. There is an association between bed net availability and use of bed net.

CHAPTER IV
RESEARCH METHODOLOGY

4.1. Introduction to the primary study

The data used for this study was primarily collected for a National Malaria Indicator Survey (MIS) in Afghanistan on October 2008. The survey was conducted by the World Health Organization (WHO) and the National Malaria and Leishmaniasis Control Program (MNLCP) _Ministry of Public Health. The survey aimed to define the epidemiology of the malaria with special reference to *P. falciparum* infection and to characterize the patterns of treatment seeking behavior among different populations (Randa et al, 2008).

- **Survey strategy:** The type of study was the cross sectional descriptive epidemiologic approach.
- **Study sites:** A total of 10 provinces were purposefully selected to reflect the three strata (Provinces are stratified in relation to malaria risk into three distinct strata). From the first strata seven provinces were selected including Kandahar, Nangarhar, Kunar, Heart, Baghlan, Faryab and Badakhshan. Nimruz and Jowzjan were the two provinces selected from the second stratum. From the third stratum, only Bamyan was selected.
- **Time of survey:** The months of October and November are the peak of the transmission season for *P. falciparum*. The survey started in an all mentioned provinces simultaneously on the 5th of November until end of the month.
- **Target population:** The permanent resident of both sexes more than six months in the selected provinces represents the population of that survey.
- **Sampling technique:** The 10 provinces included in this survey were selected purposefully to reflect the three strata of malaria risk in Afghanistan. "Province" is the survey domain to fulfill the aim of developing indicators for each province separately. "District" was the primary sampling unit; the secondary sampling unit was village. The "household" was the third sampling

unit. The unit of inquiry from which or about which data were collected was each permanent resident of the household.

- **Sample size estimation:** The sample size was estimated based on the latest prevalence figures of *P. falciparum* reported for Afghanistan in last few years which range from 5% – 10%. The sample size was estimated on the lower limit of the prevalence to obtain the largest sample. The sample size was calculated following the standard methodology applied for "Malaria Indicators Survey" considering a relative precision of 10% and correction of design effect of 1.5. The number of households to be surveyed at a national level was calculated based on an average of 7 individuals per household assuming a response rate of 90%. Using the software for sample size determination in health studies (version 2.0), the number of individuals to be surveyed at national level was 11,679 in 1,669 households.
- **Allocation of the sample size per province** The number of households surveyed in each province, district, and village/Nahia was allocated proportional to the population size based on population estimation of year 2007.
- **Selection of districts, village/Nahia and households:** The multistage cluster sample technique was used to select districts, villages/Nahia and households.
- **Pilot study:** Pilot study was conducted on the 20th of October in Arzan Qimat, Kabul to test the Dari version of the questionnaire and train participants on procedures and methods of data collection.
- **Procedures of data collection**

1. **Household:** Population census was carried to enumerate all permanent residents of the household. The head of the household was interviewed to obtain information about permanent residents of the household, household characteristics and coverage with bed nets including type, duration of ownership and members who spent the previous night under mosquito nets.

2. **Individual interview:** Household members were individually interviewed. Individuals were asked about the habit of sleeping under bed net the night of the survey. From participants above the age of 12, knowledge of malaria and malaria prevention were obtained.

- **Refusal and non-response:** Sample size was estimated assuming a non-response rate of 10% as a result of temporary absence of a household member or refusal" (Randa et al, 2008).
- **Ethical consideration:** This was done in three phases. At the initial phase formal approval was taken from the Institutional Review Board (IRB) of the Afghan Public Health Institute-ministry of public health. Later on administrative approval was sought from local authority at the province level. Finally, the purpose of the study was explained to potential study participants and written informed consent was taken from them.

4.2. Research design (The current study)

The primary data for National Malaria Indicator Survey 2008 (mentioned in detail at the beginning of this chapter) will be used as a secondary data for the study of determinants of bed net use (current study). The study design is a cross sectional comparative approach to identify the various determinants of bed nets usage among target population.

4.3. Sample size

This study uses the secondary data and it is the further analysis of data which was initially collected for the Malaria Indicator Survey (Randa et al, 2008). The sample size of primary survey was calculated based on the estimation of malaria prevalence in Afghanistan. The total number of 171 households which were the total surveyed population of previous survey in this province is selected as the sample size for this study.

In order to make sure that the selected sample size for this study meets the minimum requirement for sample size calculation, the sample size for this study

was re-calculated using the software for hypothesis test for two proportions (Lemeshow_1996-98):

$$n = \frac{\{z_{1-\alpha/2}\sqrt{2\overline{P}(1-\overline{P})} + z_{1-\beta}\sqrt{P_1(1-P_2)+P_2(1-P_2)}\}^2}{(P_1-P_2)^2}$$

P_1=48% (The proportion with less number of rooms in another survey)

P_2=31% (The proportion with high number of rooms in same survey)

(NUWAHA, 2001)

Power of test: (1- β) =80% Level of significance (α) =5%

n = 129

After this process, the minimum sample size for this study was calculated (129) which is less than the selected target sample 171. So we can conclude that the sample size for this study is enough and appropriate for further analysis.

4.4. Sampling technique

The province level is purposefully selected based on justification that was elaborated on page 9 of this report. The multistage cluster sampling technique is used to select districts, villages/Nahia and household in the original study. Afghanistan Central Statistic Office Sampling Frame was used for the selection of the villages/Nahia. The "district" is the primary sampling unit; the secondary sampling unit is village. The "household" is the unit of inquiry or the optimal sample unit.

4.5. Data collection

The household and individual level questionnaires will be used to collect the data. The method for data collection is structured interview with head of households. The head of the household is interviewed to obtain information about permanent residents of the household, household characteristics and coverage with bed nets including type, duration of ownership and members who spent the previous night under mosquito nets and malaria related health knowledge.

4.6. Data analysis

The three steps statistical data analysis includes:

1. **Univariate analysis**: Descriptive statistics such as frequency and percentage will be used to describe the socio-demographic characteristics of the respondents, malaria related knowledge and bed net availability.
2. **Bi-variate analysis**: To identify the association between independent variables and outcome variable, and to compare proportions and find out the optimal differences, the cross-tabulation with chi-square test is used. Crude odds ratios and the 95% CI will be calculated after Univariate analysis. All variables that are found to have significant level of $p \leq 0.25$ will be the candidate for the multivariate analysis.
3. **Multi-variate analysis:** To identify independent predictors of bed net use ($p<0.05$), multivariate logistic regression procedures will be used and adjusted odds ratios calculated after multivariate analysis. The Statistical Package for Social Science SPSS (version13) used for further analysis of the data.

CHAPTER V
RESULTS

This cross-sectional comparative study has been conducted to identify the factors influencing the use of bed net in Badakhshan province of Afghanistan. The data used for this study is secondary data which was initially collected to define the epidemiology of the malaria with special reference to *P. falciparum* infection and to characterize the patterns of treatment seeking behavior among different populations in 10 provinces of Afghanistan (Randa et al, 2008). The original survey was conducted by the World Health Organization (WHO) and the National Malaria and Leishmaniasis Control Program (MNLCP) _Ministry of Public Health. The survey was conducted during the months of October and November of 2008.

The total number of 171 households which were the total surveyed population of the previous survey in this province was selected as the sample size for this study. After reducing 2 observations due to missing data, total of 169 households were the final candidate for statistical analysis after cleaning process of the data.

This chapter will present the descriptive and analytical analysis of the data. In descriptive analysis all the variables will be described as univariate analysis. During inferential analysis bi-variate and multivariate results of the variables will be described.

5.1. Results of Descriptive (Univariate) analysis

In this part the independent variables of the study such as characteristics of the head of household (Age, sex, reading ability, employment status, family size, number of rooms (availability of space), economic status and locality of the household) , malaria related health knowledge variables and bed net availability will be described.

Table 7 Descriptive analysis of socio-demographic characteristics

Variables	n	%
Sex of Head of household		
• male	156	92.3
• female	13	7.7
age group of respondents		
• <=45 y	95	56.2
• >45 y	74	43.8
Reading ability of Head of household		
• neither	118	69.8
• read	24	14.2
• Read &write	27	16.0
Employment status		
• no	75	44.4
• yes	94	55.6
Family size		
• <=7	124	73.4
• >7	45	26.6
Number of rooms		
• >4	76	45.0
• <= 4	93	55.0
Assets		
• Electricity	73	43.2
• Radio	103	60.9
• Television	40	23.7
• Telephone	51	30.2
• Refrigerator	9	5.3
• Fan	6	3.6
• Air Conditioner	3	1.8
• Bicycle	56	33.1
• Motorcycle	41	24.3
• Car or Truck	17	10.1
Economic status		
• low	86	50.9
• high	83	49.1
Locality of household		
• urban	35	20.7
• rural	134	79.3

5.1.1. Socio-demographic characteristics of the head of household

This variable includes the background characteristics of the head of household (The respondent for this study) such as: sex, age, reading ability, employment status, family size, number of rooms (availability of space), economic status and locality of the household. Table 7 shows the detail descriptive result of this variable.

As it is shown in table 7, around 92.3% (156/169) of the households were headed by males and the remained 7.7% (13/169) are females. Age of the head of households are divided into two categories which is less than / equal 45 years and more than 45 years. According to the data, the minimum age of head was 18 and the maximum was 74 with the mean 44.3 and median 45. The cut off point for age of the head of household was selected 45. The result for age shows that around 56.2 % (95/169) of the respondents were less than or equal to 45 years old and 43.8% (74/169) were over 45 years old.

The reading ability of the head of household in this phase of the analysis is divided into three categories. Respondents who can read, read & write and neither of them (Cannot read and write). As data shows only 16.0% (27/169) of the respondent were able to read and write, while 14.2% (24/169) could only read and the remaining majority 69.9 %(118/169) were unable to read and write.

In reference to the employment status, the respondents are divided into two categories whether they are employee or no. According to table 7, around 55.6% (94/169) of the respondents were employee or have a paid job while the remaining 44.4% (75/169) had no employment. The Family size variable is divided into two category, less than or equal to 7 and more than 7. According to the data, the minimum family size of this data set is 2 and the maximum number is 20 with the mean of 6.6 and median of 6. But the cutoff point for family size was selected based on the accepted average family numbers in Afghanistan which is 7 and is closed to the mean of age variable. According to table 8, majority of the households 73.4% (124/169) had equal or less than seven members while 26.6% (45/169) of the households had more than seven members.

Number of rooms was divided into two categories, more than 4 rooms and equal or less than 4 rooms. As frequency distribution describes, the minimum room number of this data set was 2 and the maximum was 12 with mean of 4.6 and median of 4. So the cut off point for this variable was selected 4. According to the result shown in table 7 around 55.0% (93/169) of the households had less than or equal to four rooms or quarters while the remaining 45.0% (76/169) had more than four rooms.

The economic status of the households was described by two variables (The detailed information of the assts that the household possessed and the economic status of the households based on these assets whether it was high or low). The household assets are divided into 10 categories and based on the descriptive result of the data set in table 7 , among the surveyed households 43.2% (73/169) households had electricity, 60.9% (103/169) households had radio, 23.7% (40/169) households had television, 30.2% (51/169) households had telephone , 5.3% (9/169) households owned refrigerator, 3.6% (6/169) household had fan, 1.8% (3/169) had air conditioner , 33.1% (56/169) had bicycle, 24.3% (41/169) had motorcycle and 10.1% (17/169) owned car or truck.

The second variable for economic status was divided into two category of high and low. The cut off for high and low status derived from scoring the (weighing) and computing the different assts items based on their price. And the median score of 20 was selected as a cutoff point. According to the result in table 7, around 50.9% (86/169) of the household came under the low economic status while the remaining 49.1% (83/169) had high economic status. In reference to the locality of the households, the data shows that 79.3% (134/169) of the households lived in rural areas and around 20.7% (35/169) households were located in urban areas.

5.1.2. Malaria related health knowledge of the head of household

This part of the analysis was focused on the malaria related health knowledge of the head of household which included: Perception of the risk of malaria, the mode of malaria transmission, the best measure to prevent malaria,

exposure to health education about malaria and the source of health education. Table 8 presents the descriptive result of malaria related health knowledge of the head of households in this study.

Table 8 Descriptive analysis of malaria related health knowledge

Variables	n	%
Perception of the risk of malaria		
• don't know	35	20.7
• no risk at all	2	1.2
• very low risk	19	11.2
• low risk	60	35.5
• high risk	53	31.4
Mode of malaria transmission		
• don't know	37	21.9
• contaminated food and drinks	5	3.0
• contact with infected person	2	1.2
• mosquito bite	124	73.4
• bite of other insects other than mosquito	1	0.6
Best preventive measure		
• don't know	32	18.9
• keep the surrounding clean	10	5.9
• use of bed net	105	62.1
• use of mosquito repellant	4	2.4
• screening windows	14	8.3
• spraying insecticides indoor & outdoor	3	1.8
• screening windows and spraying insecticides	1	0.6
Knowledge about malaria		
• Malaria is a risk	132	78.1
• Malaria is transmitted by mosquito bite	124	73.4
• Prevention of malaria by use of mosquito net	105	62.1
Received health education		
• no	80	47.3
• yes	89	52.7
Source of education message		
• did not receive	80	47.9
• health facility	27	16.2
• others	60	35.9

According to the results presented in table 8, while asking whether is malaria a risk in your area or no , around 31.4% (53/169) of the respondents knew that the malaria is a high risk, 35.5% (60/169) of the respondents answered as low risk, 11.2% (19/169) of the respondents mentioned malaria as very low risk, 1.2% (2/169) of the respondents replied that malaria was no risk at all in their area and the remaining 20.7% (35/169) respondent did not know whether malaria is a risk in their area or no.

In regard to the mode of transmission, out of 169 respondents 73.4 %(124/169) answered that mosquito bite is the mode of transmission for the malaria. 1.2% (2/169) mentioned the contact with infected person as a mode of transmission, 0.6% (1/169) answered the bite of other insects than mosquito, 3.0% (5/1609) mentioned contaminated food and drinks as the mode of transmission for the malaria and the remaining 21.9% (37/169) respondents did not know about transmission of malaria.

Preventive measures: while answering about best measure to prevent malaria, 62.1% (105/169) respondents said that use of bed net is the best preventive measure. 8.3% (14/169) respondents mentioned the screening windows as the best measure, 5.9% (10/169) said about keeping the surrounding clean, 2.4% (4/169) mentioned about use of mosquito repellant, 1.8% (3/169) reported spraying insecticides indoor and outdoor as a best preventive measure, 0.6% (1/169) reported screening windows and spraying insecticides, and the remaining respondents 18.9% (32/169) did not know about best preventive measure to prevent malaria.

In the next step, the aforementioned three variables were combined to show what percentage of the respondents replied the correct answers. By general, 78.1% (132/169) of the respondents mentioned that malaria is a risk in their area, 73.4% (124/169) of the respondents reported that malaria is transmitted by mosquito bite and 62.1% (105) respondents said that use of mosquito net (bed net) is the best measure to prevent malaria.

According to the results in table 8, 52.7% (89/169) respondents reported that they had received the health education about malaria so far. The remaining 47.3% (80/169) never been exposed to health education about malaria. While asking about the source of health education they received, 35.9% (60/167) respondents reported that they received the health education from other sources, 16.2% (27/167) of the respondents reported health facility as the source of the health education. The "Others" sources mean: radio/TV, newspaper, workplace, mosque, family and friends, posters and also combinations of these places as decried below:

Table 9 Descriptive analysis of source of health education

Variables	n	%
Did not receive health messages about malaria	80	47.3
Radio/TV	33	19.5
newspaper	5	3.0
health facility	11	6.5
workplace	2	1.2
mosque	7	4.1
Radio/TV and newspaper	4	2.4
Radio/TV and health facility	13	7.7
Radio/TV and workplace	1	0.6
Radio/TV and mosque	5	3.0
Newspaper and health facility	2	1.2
Newspaper and mosque	1	0.6
Mosque, family and friends	2	1.2
Radio/TV, health facility and mosque	1	0.6

Missing=2 cases (total 167 observation)

Based on the result presented in table 9, among respondents who reported receiving the health education the maximum percentages relates to radio/TV (19.5%) and the minimum percentage belongs to workplace with 1.2 %.

5.1.3. Bed net availability

Bed net coverage (availability of bed net) : According to the descriptive result presented in table 10 , the bed net coverage found in this study is only 18.9% among surveyed population and (32/169) of the respondents reported that they own at least one bed net while majority of the respondents said that they don't have bed net 81.1%(137/169).

Table 10 Descriptive analysis of bed net availability

Variables	n	%
Bed Nets Availability		
• no	137	81.1
• yes	32	18.9

5.1.4. Use of bed net (Sleeping habit under bed net):

Sleeping under bed net is the outcome variable of this study. According the operational definition of the variables, it is the number of respondents who reported the habit of sleeping under bed net at the prior night of the interview. According to the result in table 11 , around 16.6% (28/169) respondents reported sleeping under bed net at the night of interview while 2.4 % (4/169) reported not sleeping although they had bed net and 81.1% (141/169) of the respondents did not have the bed net. Out of 28 bed net users (who reported sleeping) 1.8% (3/169) used untreated bed net, 7.7% (13/169) used ITN and 7.1% (12/169) used LLIN.

Table 11 Descriptive analysis of sleeping under bed net

Variables	n	%
Sleeping under bed net		
• don't have bed net	137	81.1
• no	4	2.4
• untreated	3	1.8
• ITN	13	7.7
• LLIN	12	7.1
Sleeping under bed net		
• no	141	83.4
• yes	28	16.6

5.2. Inferential analysis (Analytical statistics)

In this phase of the data were analyzed in two different steps as mentioned below:

- **The bi-variate analysis:** To identify the association between socio-demographic characteristics, knowledge of malaria and bed net characteristics with outcome (dependant variable), to analyze the individual effect of each individual predictor with outcome variable, and to compare differences among variables the cross-tabulation with chi-square test was used and crude odds ratios and the 95% confidence interval were calculated after univarite analysis. All variables that are found to have significant level of less than ≤ 0.25 were candidate for the multivariate analysis.
- **Multi-variate analysis:** To analyze the effect of all variables and identify the strongest predictor of bed net use, multiple logistic regression was applied. Adjusted odds ratios were calculated after multivariate analysis.

5.2.1. Bi-variate analysis:

The results of bi-variate analysis for assessment of the association between each independent variables and use of bed net (the outcome variable) are shown in table below (table 12 and 13). Variables analyzed in this phase were: socio-demographic characteristics of head of household and malaria related health knowledge variables. Only one variable (bed net availability) was excluded from this phase due to observed similarity between this variable (bed net availability) and the sleeping under bed net (Outcome variable) during descriptive dat.

The following two tables (12 & 13) will show all the details of the chi square test, odds ratio, and 95% confidence interval.

5.2.1.1. The bi-variate analysis of the socio-demographic characteristics of the head of household

In this step, association between socio-demographic characteristics of the head of household such (age, sex, reading ability, economic status, family size, employment status, number of rooms and locality) and outcome variable (use of bed net) was compared.

Table 12 Bi-variate analysis of the socio-demographic characteristics

Variables	Sleeping under bed net				p-value	OR	95 % CI
	no		yes				
	n	%	n	%			
Age of head of household					0.299		
• <=45 y	82	86.3	13	13.7			
• >45 y	59	79.7	15	20.3		1.60	0.71 - 3.62
Sex of head of household					0.234		
• male	132	84.6	24	15.4			
• female	9	69.2	4	30.8		2.44	0.69 - 8.58
Reading ability					0.119		
• no	102	86.4	16	13.6			
• yes	39	76.5	12	23.5		1.96	0.85 - 4.52
Economic status					0.098		
• low	76	88.4	10	11.6			
• high	65	78.3	18	21.7		2.10	0.91 - 4.88
Family size					1.000		
• <=7	103	83.1	21	16.9			
• >7	38	84.4	7	15.6		0.90	0.36 - 4.89
Employment status					0.211		
• no	66	88.0	9	12.0			
• yes	75	79.8	19	20.2		1.86	0.79 - 4.39
Number of room					0.007		
• >4	70	92.1	6	7.9			
• <= 4	71	76.3	22	23.7		3.62	1.38 - 9.45
Locality of household					0.125		
• urban	26	74.3	9	25.7		2.09	0.85 - 5.15
• rural	115	85.8	19	14.2			

The results of the Bi-variate analysis for the assessment of association between socio-demographic characteristics (independent variables) and outcome variable (use of bed net) are shown in table 12.

According to the result of bi-variate analysis, there is an association between the ***age*** of head of household and outcome variable (sleeping under bed net). But this association is not statistically significant (p-value 0.299). Comparing two *age groups,* 20.3% of the respondents who are more than 45 years old used the bed net while only 13.7% of respondents who are equal and less than 45 years reported sleeping under bed nets. In reference to the ***sex*** of respondents, association was found between sex of head of household and outcome variable, but this association is not statistically significant (p-value 0.234). The result shows that 30.8% of the female respondents and used bed nets while only 15.4% of the male respondents reported sleeping under bed net.

The association between ***reading ability*** and use of bed net is not statistically significant (p-value 0.119). According to result 23.5% of the respondents who can *read* are the bed net users while 13.6% of the respondents who can't read, reported the use bed net. This association is not significant but candidate for multi variate analysis. For the economic status of the respondents, association was found between this variable and use of bed net but not statistically significant (p-value 0.098). Based on findings, 21.7% of the high *economic* category used bed nets while around 11.6% of the low economic class reported the use of bed net.

There was no association between family size and use of bed net. (p-value 1.000). Based on result 15.6% of households with more than seven (>7) *family m*embers used bed while 16.9 % of the households which had less than or equal seven members (<=7) reported use of bed net.

Association between employment *status* and use of bed net was not statistically significant (p-value 0.211). According to the result 20.2% of the respondents who had an employment or paid job used the bed nets and 12.0% of the bed nets users were from no employment category.

There was a strong association between number of rooms and use of bed net and this association was statistically significant (p-value 0.007). Big difference was found between households who had available *rooms* more than 4 and less than 4. 23.7% respondents having equal or less than 4 rooms used the bed nets while this figure was 7.9% for respondents with more than 4 rooms.

The association between *Locality* and use of bed net was not significant (p-value 0.125). However, comparing the proportions, 25.7% of the respondents who lived in urban areas were bed net users and showed two times difference comparing to the respondents living in rural areas with 14.2 %.

5.2.1.2. The bi-variate analysis of the malaria related health knowledge

In this step, association between malaria related health knowledge of the respondents (head of household) such as (Perception of the risk of malaria, mode of transmission, best preventive measure , exposure to health education and source of health education)was compared with outcome variable (use of bed net).

Table 13 Bi-variate analysis of malaria related health knowledge

Variables	Sleeping under bed net				p-value	OR	95 % CI
	no		yes				
	n	%	n	%			
Perception of the risk of malaria					0.045		
• Don't know	35	94.6	2	5.4			
• Know	106	80.3	26	19.7		4.29	0.97 - 19.01
Malaria is transmitted by mosquito bite					0.010		
• Don't know	43	95.6	2	4.4			
• Know	98	79.0	26	21.0		5.70	1.29 - 25.11
Prevention of malaria by use of mosquito net					0.057		
• Don't know	58	90.6	6	9.4			
• Know	83	79.0	22	21.0		2.56	0.98 - 6.71
Source of health education					0.002		
did not receive	74	92.5	6	7.5			
health facility	23	85.2	4	14.8		2.15	0.56 - 8.27
others	42	70.0	18	30.0		5.29	1.95 - 14.35

According to the results of bi-variate analysis of malaria related health knowledge presented in table 13, around 19.7% of the respondents who reported malaria as a risk in their living area, were bed net users and this percentage among respondents who did not know malaria as risk in their area was 5.4 %. There was

a strong association between knowledge of risk and use of bed net (p-value 0.045).

Association between mode of transmission and use of bed net was statistically significant (p-value 0.010). 21.0% of the respondents who knew mosquito bite as a mode of transmission were bed net users while this percentage among respondents who did not mentioned the mosquito bite as a mode of transmission was 4.4 %.

The association between prevention variable and use of bed net was not statistically significant (p-value 0.057) .According to the result in table 13, 21.0% of respondents who mentioned the use of bed net as a best preventive measure used the bed nets while only 9.4% of respondents who did not mentioned the mosquito net as a preventive measure slept under bed nets.

The association between source of health education and use of bed net was statistically significant (p-value 0.002).In reference to the source of health education 30.0% of the respondents who received health education from other sources rather than health facility used bed net, 14.8 % who received the health education from health facilities were bed net users and 7.5 % of the respondents who did not receive the health education were among bed net users. The exact source for the category of "others" included: Radio/TV, newspapers, workplace, mosque and posters. (Variable of health education was merged with source of health education due to having similar result at the bi-variate phase).

At the end of the bi-variate analysis the variables with p value < 0.25 were selected as candidates for further analysis and underwent to the multi variate analysis or multiple logistic regression.

Table 14 The candidate variables for multi variate analysis (p< 0.25)

Variables	Sleeping under bed net				P value
	No		Yes		
	n	%	n	%	
Sex of head of household					0.234
• male	132	84.6	24	15.4	
• female	9	69.2	4	30.8	
Reading ability					0.119
• no	102	86.4	16	13.6	
• yes	39	76.5	12	23.5	
Economic status					0.098
• low	76	88.4	10	11.6	
• high	65	78.3	18	21.7	
Employment status					0.211
• no	66	88.0	9	12.0	
• yes	75	79.8	19	20.2	
Number of room					0.007
• >4	70	92.1	6	7.9	
• <= 4	71	76.3	22	23.7	
Locality					0.125
• urban	26	74.3	9	25.7	
• rural	115	85.8	19	14.2	
Perception of the risk of malaria					0.045
• Don't know	35	94.6	2	5.4	
• Know	106	80.3	26	19.7	
Malaria is transmitted by mosquito bite					0.010
• Don't know	43	95.6	2	4.4	
• Know	98	79.0	26	21.0	
Prevention of malaria by use of mosquito net					0.057
• Don't know	58	90.6	6	9.4	
• Know	83	79.0	22	21.0	
Source of education message					0.002
• did not receive	74	92.5	6	7.5	
• health facility	23	85.2	4	14.8	
• others	42	70.0	18	30.0	

As it is shown in table 14, out of 12 variables at the bi-variate phase two variables could not proceed to multi variate analysis (Age of head of household with p =2.99 and family size with p = 1.000).In view of chi square test all the remaining 10 variables with p-value ≤0.25 were candidate for multi variate analysis and the detail information about candidate variables is provided in table 13.

5.2.2. Multivariate analysis:

In this phase, the effect of independent variables was assessed on outcome variable using multiple logistic regressions. Variables with p value ≤ 0.25 underwent to the modeling process to control the effect of other variables. These variables included sex of head of household, reading ability, economic status, employment status, number of rooms, and locality of the household, Perception of the risk of malaria, knowledge of respondents about mode of transmission, knowledge about best preventive measure and source of health education. In the first model the adjusted odds ratio, p value and 95% confidence interval of the mentioned variables were found.

In the 1st modeling process the following result was obtained:

1. Sex: Female respondents had significant association with use of bed net. (OR= 7.93, p value = 0.027 and 95% CI (1.26-49.73).
2. Reading ability: association between respondents who was able to read and use of bed net was not significant in this step. (OR= 3.02, p value = 0.052 and 95% CI (0.99-9.22).
3. Economic status: No significant association between respondents with high economic class and use of bed net. (OR= 1.54, p value = 0.438 and 95% CI (0.52-4.54).
4. Employment status: Association between employment status and use of bed nets was not significant. (OR= 3.08, p value = 0.086 and 95% CI (0.85-11.15).
5. Number of rooms: Significant association was found between number of rooms ≤4 and use of bed net. (OR= 3.48, p value = 0.024 and 95% CI (1.17-10.29).
6. Locality: Significant association between locality of the household and use of bed net was found. Households living in urban area 12 times use the bed net comparing to households living in rural. (OR= 11.88, p value = 0.001 and 95% CI (2.91-48.51).

7. Knowing malaria as a risk: No association between knowledge about risk of malaria and use of bed net. (OR= 0.44, p value = 0.479 and 95% CI (0.04-4.33).
8. Knowledge about mode of transmission: The association between knowledge about transmission of malaria and use of bed net was not significant. (OR= 8.39, p value = 0.115 and 95% CI (0.60-117.90).
9. Knowledge about prevention of malaria: No association between prevention knowledge of malaria and use of bed net. (OR= 0.98, p value = 0.983 and 95% CI (0.24-4.07).
10. Source of education: The association between others source of health education and use of bed net was significant. (OR= 5.30, p value = 0.014 and 95% CI (1.39-20.19).

After applying the first model with the abovementioned results another six consecutive multiple logistic regression models were applied. Using the level of significance ($p<0.05$) as cut of point in this stage the following six variables were cancelled out during correspondent models as below:

1. Knowledge about prevention of malaria :
   This variable was excluded in Model 2 (OR= 0.98, p value = 0.983 and 95% CI 0.24-4.07).
2. Perception of the risk of malaria :
   This variable was excluded in Model 3 (OR= 0.44, p value = 0.479 and 95% CI 0.04-4.33).
3. Economic status:
   This variable was cancelled out during Model 4 (OR= 1.57, p value = 0.405 and 95% CI 0.54-4.55).
4. Knowledge about mode of transmission :
   It was excluded in Model 5(OR= 4.91, p value = 0.102 and 95% CI 0.73-33.01).
5. Employment status:
   This variable was out during Model 6(OR= 2.99, p value = 0.083 and 95% CI 1.32-10.95).

6. Sex of household:

   It was the last variable which was excluded in Model 7 (OR= 3.29, p value = 0.128 and 95% CI 0.71-15.20).

As an outcome of final model in multiple logistic regression process, four out of ten variables proved to be associated (statistically significant) with outcome variable. The result of last model is shown in the next table.

Table 15 The final model of multiple logistic regression

Variable	β	OR	Wald	Sig.	CI (95%)	
					Lower	Upper
Reading ability						
• can't read		1.00				
• can read	1.04	2.83	4.17	0.041	1.04	7.69
Number of room						
• > 4		1.00				
• <= 4	1.47	4.35	7.77	0.005	1.55	12.21
Locality						
• rural		1.00				
• urban	1.70	5.50	8.14	0.004	1.71	17.73
Source of health education						
• did not received		1.00				
• health facility	0.89	2.45	1.45	0.228	0.57	10.47
• others	1.85	6.38	10.66	0.001	2.10	19.43
Constant	-4.36	0.01	36.28	0.000		

-2 log likelihood = 120.859a

After multiple modeling process and reducing the number of insignificant variables four variables were found as the bed net use predictors. The detail of findings for the final model:

1. **Source of health education** was the strongest predictor of bed net use in this study. Respondents who received the health education from “other” sources used bed net 6.38 times more than respondents who did not received the health education (reference). The odds ratio for this association was 6.38, p value =0.001 and 95% CI (2.10-19.43). “Other” source includes Radio/TV, newspapers, workplace and mosque.

2. The second variable with significant association was the **locality** of household and use of bed net. Respondents living in urban area had the habit of sleeping under bed net 5.50 times more than the people who lived in rural area with OR = 5.50, p value =0.004 and 95% CI (1.71-17.73).
3. The third predictor of bed net use in this study was the **number of rooms**. Households having equal or less than 4 rooms used bed net 4.35 times more than households having more than 4 rooms. OR=4.35 , p value 0.005 and 95% CI (1.55- 12.21)
4. The last variable which was significantly associated with use of bed net was the **reading ability** of the head of household. Respondents who can read had used bed net 2.83 times more than respondents who cannot read. OR=2.83 , p value 0.041 and 95% CI (1.04- 7.69)

CHAPTER VI
DISCUSSION

This study is aimed to identify the factors influencing the use of bed net and to determine the bed net coverage in Badakhshan province, Afghanistan. The data used for this study is secondary data obtained from the Malaria Indicator Survey conducted by WHO and NMLCP _ Afghanistan during October-November 2008 and it is the further analysis of mentioned survey with different objectives and aims.

The study shows that 18.9% of households in surveyed population had owned at least one bed net. An accurate assessment to identify the gaps in household ownership and individual use is a crucial step in devising evidence-based and province-specific strategies to increase population coverage with ITNs and work towards the interruption of malaria transmission. No previous data of bed net coverage and utilization in this province is available so far.

Badakhshan is one of the high risk malaria endemic provinces (NMLCP, 2008); meanwhile lack of valid epidemiological data makes the comparison process difficult. Comparison of the finding with general population is also difficult, since Badakhshan has very scattered population with different terrains and no large surveys have recently been conducted in this province. In September 2007, malaria outbreak was reported from Faiz Abad city, the center for Badakhshan province. “Established active surveillance system identified a total of 336 cases of *P. falciparum*” (Randa et al, 2008).

Bed nets are one of the best vector control intervention and key tool for malaria prevention in endemic area. The WHO Global Malaria Program (WHO/GMP) recommends the distribution of insecticide-treated nets (ITNs), more specifically long-lasting insecticidal nets (LLINs), as one of the main interventions for effective malaria control, which must be scaled up if countries are to move towards achieving the United Nations Millennium Development Goals by 2015 (WHO, 2007).

Despite continuous efforts by national health programs to intensify the preventive measures, still coverage and utilization rate of the bed net is very low among communities. There are too many factors / determinants affecting the use of bed net such as socio-demographic characteristics, economic status, access to health facilities, locality of the households and others.

Based on findings of this study some socio-demographic characteristics and malaria related health knowledge of the respondents had no significant association with outcome variable of this study. However, this finding may not necessarily implicate that these factors were not important. The role of these predictors could not be ignored and they have their theoretical and practical implication as it is already proven by other studies. If some of the most important variables had no significant association in this study, the reasons might be the small sample size, differences in the context of survey site, deferent methodology or some another issues that will be elaborated in next pages.

6.1. Limitation of the study

1. **Data quality** : As for the current study has been conducted based on secondary data , which was collected earlier for another purpose with different design , the chance of facing with the following challenges become more obvious:
   - No chance for selecting the required study design
   - No control over how the instrument is designed, how data are collected, or how carefully they are manipulated and documented
   - The data don't meet the purpose of study and not appropriate to our specific objectives. Does not permit formulating research question.
   - Difficult to developing concepts relevant to the available theories
2. **Sample size:** In samples with minimum number of observations the data will be susceptible to imprecision and lack of adequate statistical power which leads to high number of insignificant associations. The total number of surveyed population in the primary survey (171 household)was selected as

the sample size for this study which is not adequate and may not fully representative for a descriptive study.

3. **Sampling:** Selecting the head of household as the only respondent of the survey may be a bias. This may not represent the whole family member's characteristics.
4. **Limitations during data analysis:** Some of the recoding approaches which were applied during analysis may not have powerful justifications. For example, there is not a well-defined indicator for socio-economic status for low-income countries therefore, proxy measures, such as ownership of property, reading ability, and employment status were used to measure the conceptualized variables. Selection of context-driven cut-off points may lead to misdistribution of observations in to the wrong categories, leaving distorted results.

6.2. Factors influencing the use of bed net

6.2.1. Age

Age is a common person variable associated with risk of diseases, with physiological differences and also parallels to chronologic time. Age in this study refers to the head of household. According to the descriptive analysis of this study, age of the head of households was divided into two categories which is less than or equal 45 years and more than 45 years. The minimum age of head of household was 18 and the maximum was 74 with the mean 44.3 and median 45. The cut off point for age of the head of household was selected 45 based on median. The result for age shows that around 56.2 % (95/169) of the respondents were less than or equal to 45 years old and 43.8% (74/169) were over 45 years old.

According to the result of bi-variate analysis, there was an association between the age of head of household and outcome variable (sleeping under bed net). But this association was not statistically significant (p-value 0.299 COR= 1.60). Comparing the proportions, 20.3% of the respondents who are more than 45

years old used the bed net while only 13.7% of respondents who are equal and less than 45 years reported sleeping under bed nets. Due to having p value more than 0.229 after applying the chi square test this variable was not candidate for multivariate analysis.

Although, role of age as a specific person variable is dominant in epidemiology, this study revealed that age has no association with outcome variable of this study. The possible reasons could be over-emphasizing of the study on the age of head of house hold, not age of family members. Also the age groups was categorized only into two groups (=<45 and >45). So this may not reflect the real association of age with use of bed net.

Considering the fact that children under five and women of reproductive age are the main bed net users, the required information was not obtained from this study, due to selection bias of head of household as the main respondents. Despite contextual variability in other countries some study result supports our findings. If we compare this result with another survey in Lake Victoria in western Kenya, when the explanatory variables, age, sleeping arrangement, and village were examined against an individual's bed net use, age, village and the interaction terms were dropped from the final model. The objectives of this study were to explore whether an individual's sleeping arrangements and house structure affect bed net use. (Iwashita 2010)

6.2.2. Sex

Sex variable had no significant association with outcome variable during multi variate analysis and canceled out in model 7 of logistic regression. (p value= 0.128 , AOR=3.29 , 95% CI 0.71-15.20). According to the result of bi-variate analysis, 30.8% of the female respondents used bed nets while only 15.4% of the male respondents reported sleeping under bed net.

Male category has dominant role in households in Afghanistan and head of household was the only respondents of this study. So the result could be distorted due to this selection bias. According to descriptive findings only 13% of the household were headed by females.

The women of reproductive age are the prime focus in malaria control interventions and they make a big proportion of bed net users. A study in Ethiopia on 2007 was conducted to assess coverage, use and access to scaled-up malaria prevention and control interventions. The study reveals that of 5,083 surveyed households, 3,282 (65.6%) owned at least one ITN. In ITN-owning households, 53.2% of all persons had slept under an ITN the prior night that 1,891/3,009 (60.9%) of them were women 15 - 49 years of age, and 166/266 (65.7%) of pregnant women (Jima, 2007). An ethnographic household survey in central Kenya to address the socio-economic and geographical diversity revealed that one of the factors significantly caused variation in bed net use was gender ($\chi^2 = 4.254$; df 1; P = 0.039) (Peter et al, 2009).

6.2.3. Reading ability

Based on the result of multi variate analysis reading ability had significant association with use of bed net. (OR=2.83 and p value = 0.041, 95% CI 1.04-7. 69). According to descriptive analysis 16.0% of the respondent were able to read and write, while 14.2% could only read and the remaining majority 69.9 were unable to read and write. According to bi-variate analysis 23.5% of the respondents who can *read* are the bed net users while 13.6% of the respondents who can't read, reported the use bed net.

Reading ability has a profound influence on the perception of the users. In a similar study that was conducted in Congo, education level (z = 2.29, p = 0.022) was significantly associated with bed net use at the household level. (Ndjinga 2010) . This finding is also supported by another study in central Mozambique and bed net ownership and usage was significantly associated with education (odds ratios for association with bed net ownership: 5.6 for highest educational level compared with no education) (Brentlinger 2006)

6.2.4. Economic status

This variable was not significantly associated with use of bed net. The multi variate result of this variable shows the (p value =0.405 AOR = 1.57 and 95% CI 0.54-4.55). According to descriptive analysis around 50.9% (86/169) of the household came under the low economic status while the remaining 49.1% (83/169) had high economic status. In bi-variate analysis 21.7% of the high *economic* category used bed nets while around 11.6% of the low economic class reported the use of bed net.

It is obvious that use of bed net is associated with income of families. Due to unavailability of well developed socioeconomic indicators for the context of low income countries; proxy measures, such as ownership of property was used and scoring (weighting) approach was applied to define the economic status of households. This approach may not necessarily work in this context. The other studies are quite supportive of socio-economic factors in favor of bed net usage. In a study in central Mozambique bed net ownership was significantly associated with higher socio-economic status (odds ratios for association with bed net ownership: 2.1 for automobile ownership compared with transportation on foot). (Brentlinger 2006)

6.2.5. Family size

Family size had no association with outcome variable at all (p value=1.000) during bi-variate analysis. The Family size variable was divided into two category, less than or equal to 7 and more than 7. According to the data, the minimum family size of this data set is 2 and the maximum number is 20 with the mean of 6.6 and median of 6. But the cutoff point for family size was chosen based on accepted average family numbers in Afghanistan which is 7 and is closed to the mean of age variable. According to descriptive analysis majority of the households 73.4% (124/169) had equal or less than seven members while 26.6% (45/169) of the households had more than seven members. Based on bi-variate analysis 15.6% of households with more than seven (>7) family members

used bed while 16.9 % of the households which had less than or equal seven members (<=7) reported use of bed net.

Theoretically, there should an association between size of family and use of bed net. Big families need more space, bed rooms and adequate income to afford the price of bed nets. As much as the size of family gets bigger the chance of using bed will be low. Based on result of a cross-sectional study in Binh Phuoc Province, Vietnam to identify the risk factors for malaria infection family size of > or =5 people associated with malaria infection (Abe T et al 2009). But in this study, the problem with categorization may lead to this insignificant result.

6.2.6. Employment status:

This variable was not significantly associated with outcome variable and it was reduced during logistic regression (p value = 0.065, AOR=2.99 95% CI 0.87-10.27). According to descriptive result of this study 55.6% of the respondents reported to have an employment or paid job. According to bi-variate result 20.2% of the respondents who had an employment or paid job used the bed nets and 12.0% of the bed nets users were from no employment category? Employment status has a dominant contribution with use of bed net.

Employment has relation with income, education and locality of the households. In a study of bed net use and associated factors in a rice farming community in Central Kenya , the employment status was one of the factors which significantly caused variation in bed net use ($\chi 2 = 7.955$; df 3; P = 0.047) (Peter 2009) . The reason for insignificancy of the employment in this study may be different residential set up, as majority of the rural communities do not have paid job and only small proportion of people in urban areas have employment.

6.2.7. Number of rooms:

Number of rooms was another factor significantly associated with used of bed net, in particular household with equal or less than four rooms (OR=4.35 and p value = 0.005, 95% CI 1.55-12.21). Number of rooms was divided into two categories, more than 4 rooms and equal or less than 4 rooms.

As frequency distribution describes, the minimum room number of this data set was 2 and the maximum was 12 with mean of 4.6 and median of 4. So the cut off point for this variable was selected 4. According to descriptive 55.0% (93/169) of the households had less than or equal to four rooms or quarters while the remaining 45.0% (76/169) had more than four rooms. In bi-variate analysis big difference was found between households who had available *rooms* more than 4 and less than 4. Around 23.7% respondents having equal or less than 4 rooms used the bed nets while this figure was 7.9% for respondents with more than 4 rooms.

According to study in Kinshasa, Democratic Republic of the Congo, number of rooms ($z = 3.81$, $p < 0.001$) were significantly associated with bed net use at the household level. (Ndjinga 2010).

6.2.8. Locality:

Locality of the household was the second variable with highest odds ratio and was significantly associated with use of bed net. (OR=5.50 and p value = 0.004, 95% CI 1.71-17.73). In reference to the locality of the households, the data shows that 79.3% (134/169) of the households lived in rural areas and around 20.7% (35/169) households were located in urban areas. However, comparing the proportions, 25.7% of the respondents who lived in urban areas were bed net users and showed two times difference comparing to the respondents living in rural areas with 14.2 %.

This finding was supported by study in central Mozambique which indicates that "Higher levels of bed net (treated or untreated) coverage (over 50%) were achieved in urban or peri-urban sites than in rural sites (as low as 15%) (Brentlinger 2006).

6.2.9. Malaria related health knowledge :

This variable included three indicators which were not significantly associated with outcome variable. Knowledge of people about risk of which was not significantly associated with use of bed net (p value = 0.479 AOR 0.44 and 95%

CI 0.04-4.33), the mode of transmission of malaria with no significant association (p value= 0.102 AOR 4.91 and 95% CI 0.73-33.01), and the best measure for prevention of malaria with (p value = 0.983 AOR 0.98 and 95% CI 0.24-4.07).

Although no significant association was found between malaria knowledge and bed net use in this study, other studies supports this association. In a study in Nigeria none of the subjects in the intervention and control groups knew about or used ITNs before the study, X 2 = 1.00, P>0.30. Ninety-eight percent (98.1%) of subjects in the intervention group and 96.2% in the control group desired to own and use ITNs after they were initially informed about the use and benefits (Igwe PC et al 2007).

6.2.10. Source of health education:

Source of health education was the strongest predictor for the use of bed net and (Radio/TV, newspapers, workplace and mosque) were significantly associated with use of bed net (OR=6.38 and p value = 0.001, 95% CI2.10-1943). The wide range of Confidence interval is due to small sample size. According to descriptive results 52.7% (89/169) respondents reported that they had received the health education about malaria so far. The remaining 47.3% (80/169) never been exposed to health education about malaria. While asking about the source of health education, 35.9% (60/167) respondents reported that they received the health education from other sources, 16.2% (27/167) of the respondents reported health facility as the source of the health education.

Based on bi-variate analysis 30.0% of the respondents who received health education from other sources rather than health facility used bed net, 14.8 % who received the health education from health facilities were bed net users and 7.5 % of the respondents who did not receive the health education were among bed net users. The exact source for the category of “others” included: Radio/TV, newspapers, workplace, mosque and posters. (Variable of health education was merged with source of health education due to having similar result at the bi-variate phase).

If we compare different sources of health education with health facility, the respondents reported the radio, TV, newspaper, workplace and mosque as the main source of their health education in comparison to the health facility. This result implicates that communities in rural area have a scattered set up of living and they are located in remote and isolated area which have no access to basic health centers.

Other possible interpretation could be the ineffectiveness of available approach of health facilities toward provision of health messages. Health facilities usually emphasize on the printed health messages materials, although a big proportion of people have no ability to read especially in the rural are. The health education sessions are not regularly and sufficiently provided at the health centers. That's why this study indicates that the health education seems to be more effective through other sources comparing to the health facilities.

6.2.11. Availability of bed net

Availability of bed net was one of the variables included in conceptual framework. Two objectives were related to this variable, to identify the association of bed net availability and to determine the bed net coverage among surveyed population. According to the descriptive result the bed net coverage found in this study was only 18.9% among surveyed population and (32/169) of the respondents reported that they own at least one bed net while majority of the respondents said that they don't have bed net 81.1%(137/169).

Based on cross-tabulation analysis the proportion of respondents who reported owning bed net was similar and equal with proportion of bed net users. Due to this similarity this variable was excluded in Bi-variate analysis.

6.2.12. Sleeping under bed net

Sleeping under bed net is the outcome variable of this study. According the operational definition of the variables, it is the number of respondents who reported sleeping under bed net at the prior night of the interview. According to the descriptive result, around 16.6% (28/169) respondents reported sleeping

under bed net at the night of interview while 2.4 % (4/169) reported not sleeping although they had bed net and 81.1% (141/169) of the respondents did not have the bed net. Out of 28 bed net users (who reported sleeping) 1.8% (3/169) used untreated bed net, 7.7% (13/169) used ITN and 7.1% (12/169) used LLIN.

CHAPTER VII
CONCLUSION AND RECOMMENDATION

7.1 Conclusion

In conclusion, this study was successful to find out at least some of the anticipated associations between pre-defined predictors and the outcome variable, as it was initially conceptualized .The selected sample provided a representation of the all population subgroups in Badakhshan province of Afghanistan.

This survey revealed that the source of health education, locality of household, number of rooms and reading ability of the head of household were the important factors influencing the use of bed net in Badakhshan province . These variables were significantly associated ($p<0.05$) with use of bed net. These factors which also called the factors in favor of bed net usage are more elaborated as below:

1. Source of health education (TV, radio, newspapers, workplace, mosque)
2. Locality of household (Urban population)
3. Number of rooms (Equal and less than 4 rooms)
4. Reading ability of the head of household

This study indicates that the important factor and strongest predictor for bed net usage in this province is the source of health education (Radio, TV, newspaper, workplace, and mosque). This study proved that these sources are the most effective means of health education about malaria prevention for the surveyed population. Based on the result of this study, people who receive health messages about malaria from (Radio, TV, newspaper, workplace, and mosque) use the bed net three times more than people who receive health education only from health facilities.

Locality was the second important factor influencing the use of bed nets among surveyed population. The urban population reported the habit of sleeping under bed nets six times more than people who lived in rural areas.

Households who owned equal or less than four rooms reported habit of using bed nets five times more than people who had more number of rooms.

Reading ability of the head of household was the other important variable having significant association with the use of bed net. Head of households, who were able to read, reported the habit of sleeping under the bed net three times more than the respondents who were not able to read.

Bed net coverage was low (18.9 %) in Badakhshan province with much lower coverage of (16.4 %) in rural population and (28.6%) in urban population. (16.6%) of the surveyed population reported the habit of sleeping under bed nets with almost same distribution of bed availability in rural and urban population. (Urban 25.7% and rural 14.2%)

The remaining factors such as sex, age, employment status, family size, economic status, malaria related health knowledge of the respondents and availability of bed had no significant association with use of bed net in this province.

7.2 Recommendations

This part includes the recommendations based on findings of the study. In order to improve the situation the following recommendations are suggested:

1. Expansion of bed net coverage is the most important recommendation of this study. More treated bed net should be distributed in high risk provinces.
2. Non-Governmental Organizations (NGOs) that implement BPHS and EPHS in high risk provinces should reinforce the bed net distribution programs and ensure the accessibility of vulnerable groups to bed net. Distribution of free bed nets trough Ante Natal Care (ANC) and during the immunization programs will be effective and should be continued.

3. CHWs (Community health workers) should distribute the bed nets through their health posts to people who live in remote areas and will not have access to the source of bed nets.
4. Intensification of the Information, education and communication efforts is highly recommended to enable communities to adopt behavior that prevent risk of malaria.
5. Health education messages should emphasize on risk of malaria and address measures of preventing against this disease with special emphasis on effectiveness of insecticide treated bed nets. Local idioms that are more culturally suited to the target audience should be used to enhance the overall effectiveness of communication activities.
6. Health care facilities should consider health education activities of malaria as part of their routine services provided to population. Applied health education approaches should be re-assessed and re-vitalized to ensure the effectiveness.
7. Health education messages using mass media will ensure the wide spread of accurate and up to date information. Radio and television are the most suitable mass media in view of the high rates of illiteracy among population.
8. Training of local change agents at community level could be an effective communication method for provision of health messages. Theses change agents may include members of village health committees, religious leaders (Immam), leaders of women groups (Specific NGOs), CHWs, school focal points and newspapers.
9. Health messages note books and brochures should distributed to schools and other religious training centers (Madrassa).
10. Distribution and installation of the posters at the public gathering places and mosques should be incorporated in routine programs of NGOs.
11. Inter-sectorial collaboration should be enhanced to increase the school-enrollment as a long term development plan to increase the literacy rate of communities.

12. The information, report and lessons learned from this study should be made available to all partners. The result could be used at the central MoPH as well as the relevant province for the local management of the findings to address the identified gaps.
13. Survey report should be shared with implementing NGO at the province.
14. Further population based descriptive and analytical survey should be planned for the same area as well as other malarious areas which were not part of this study at this stage.

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