ECONOMIC ASSESSMENT OF DIAGNOSTIC SYSTEMS AGAINST NEGLECTED INFECTIOUS DISEASES IN AFRICAN CHILDREN UNDER FIVE YEARS OF AGE

Master Thesis

Department of Health Sciences
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Abstract

Poverty has made access to basic health care a nightmare for most people living in countries endemic with infectious diseases. Most of the infectious diseases that affect the most vulnerable in the endemic societies are neglected and relegated by many world health bodies to the “other diseases” category which makes it difficult to secure grants for researching those diseases. Unfortunately children are more affected. Clinical researchers are only interested in clinical efficacy of their trials or projects with very limited or no interest on the value for money of their projects.

Children younger than five years of age who were taken to the Pramso or Agogo hospitals were the main target of this research as they fall within the category of “most proned” to diseases. Pramso and Agogo hospitals are both located in the Bosomtwe district and Asante Akim North both in the Ashanti Region of Ghana

Lack of adequate diagnostic facilities in most local hospitals in most African countries, for instance Ghana, makes it difficult to sometime trust laboratory test results hence the establishment of a state of the art microbiological diagnostic center in the Ashanti Region of Ghana by the Bernhard-Nocht Institute for Tropical Medicine (BNITM) based in Hamburg, Germany to help all surrounding health facilities analyze specimen or samples for precise diagnostic results.

This study aimed at assessing whether the intervention by the BNITM has a real value for money or the standard diagnostics system.

A questionnaire was used to collect data from study participants and data on cost as well as their utility for the diagnostic facility in two hospitals in the Ashanti region of Ghana, Pramso and Agogo. Care-givers (parents or guardians) were made to trade perfect health with ill-health using the time trade off (TTO) method and the cost of treatment was collated right on discharge from the children wards. The net benefit of each of the diagnostic systems, the standard and the conventional, was calculated for each of the hospitals under study. The results showed that both diagnostic systems are beyond the affordability of the care-giver to some extent.

I finally found out that both the diagnostic systems of Pramso and Agogo were very expensive for care-givers who take their children there for treatment yet those at Agogo offered to pay some realistic amount of money to get medical care since most of them were very satisfied with the overall service of the hospital. Though care-givers at Pramso Hospital (stanbdard diagnostics) were “satisfied with the service” yet what they are willing to pay for the treatment of their children is far less than the actual cost of treatment.

I finally discussed how health policy makers could fix realistic price, based on the average willingness to pay so that all care-givers could access basic health and medical care. The need to collate health economic data alongside clinical and epidemiological from onset as part of the hospital database was also discussed.

Acknowledgements

Thanks to Allah (God) who gave me the courage and patience to go through life and guided me to show respect for all mankind irrespective of colour, ethnicity, language or place of origin and to observe social justice for all.

I really appreciate my parent's support, especially that of my mother, in making sure I attain education. I really appreciate the moral and logistic support of the Friedrich-Ebert-Stiftung and the Bernhard-Nocht-Institute for Tropical Medicine (BNITM) offered me in making sure my stay in the research field was successful.

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I am very much indebted to my field assistants Robert Achab, Bernhard, Kennedy, Augustina Annan, Joyce Bioh, Prof. Sarkodie and Dr. Sarpong for their hard work, guidance and advice in the field.

Finally to Aisha, my wife, for your unconditional love, understanding and support even from across the oceans. You gave me the wings to fly and you gave me the love I needed to go on which made me stay clean and pure till my return from the field.

I dedicate this thesis to my son Yunus who had to battle with his health condition; I cherish you a lot for being that young but strong. As a baby you already master how to get along with pain and most surprisingly always keep that sunny smile on your face. Wish you a speedy recovery my boy.

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1 Background

Most infectious diseases affect populations resident in the tropical regions of the world, more or less marginalized due to lower socio-economic status, yet most studies solely focus on clinical outcomes. Mostly the costs of the studies are not assessed, leading to the knowledge of clinical effectiveness but not cost effectiveness of the study conducted.

Most research efforts focus on the general population or targeting the youth, adults or the aged relegating the plight of children to the background. Though children are the most vulnerable to many diseases especially infectious ones, less attention is given to neglected infectious diseases that affect children. Lack of adequate diagnostic facilities could lead to wrongly diagnosing children which in turn leads to wrong therapy and treatment. Many studies focus on malaria but not co-infections that could lead to wrongly diagnosing a child. Treatment of malaria could pose a burden to parents or guardians and health service providers. Hence this research investigates the value for money of two different diagnostic systems, thus the standard and the conventional laboratories of Pramso and Agogo Hospitals respectively, against infectious diseases affecting children in Africa.

This work tries to answer the questions of whether care-givers (parents or guardians) of sick children are able to bear the costs of treatment, both direct and indirect. Again whether the conventional diagnostic system implemented by the Bernhard-Nocht-Institute for Tropical Medicine (BNITM) Hamburg in the Agogo Presbyterian Hospital has a real value for money, again to evaluate which of the diagnostics to assess which of the diagnostic systems has value for money in other words has its benefits outweigh its costs.

To help achieve the set objective(s) of the study, statistical, economic techniques and approaches were employed during the data collection under the pretext of a real clinical trial implemented by the BNITM of Hamburg, Germany.

Since many infectious disease are neglected, this work will narrow itself to the frame of sepsis or septicemia which is often confused with malaria during diagnosis and therefore neglected partly due to lack of appropriate diagnostic facility or due to lack of knowledge in dealing with the disease. This work will only take malaria and sepsis into consideration since all neglected diseases could not be covered within the framework of this research work.

2 Literature Review

The lack of knowledge on cost effectiveness is not the only problem but also the lack of attention to the so called “other diseases” like sepsis by international bodies. Many initiatives especially the Millennium Development Goals (MDGs) have set the control of tuberculosis, malaria and HIV/AIDS as their main target making politicians and health policy makers relegate a large group of diseases to the “other diseases” category. Nonetheless these “so-called” neglected diseases are parasitic, viral and bacterial infections. The diversion of attention from the neglected diseases calls for a poor research funding or less interest by researchers, health policy makers and politicians in the area of neglected infectious diseases (Molyneux, 2004, p. 380).

However the neglected infectious diseases do not only cause the absence of physical or mental wellbeing but also have enormous impact on individuals, their relatives, societies in the tropical regions of the world in terms of disease burden, quality of life, productivity level, high cost of care which aggravates financial woes of the affected population (WHO, 2011, p. 115).

Acknowledging the fact that major diseases receive most or all attention from the world’s citizens and organisations leaving the world’s poorest to suffer from those infectious and/or tropical diseases, many research institutions took an initiative to go into a public-private partnership with donors, health advocacy groups and philanthropists to wage an all-out battle against the so-called neglected diseases which yielded some fruit in the case of Chagas disease (Mayor, 2008, p. 1396). Though some success has been achieved through this partnership, yet still the donors and governments are still faced with the problem of setting priorities for health research investment as well as health interventions, hence the need for an economic assessment to investigate the option that has better value for money or to find out which intervention is worth investing (Mathers, Ezzati, & Lopez, 2007, p. 1).

Nowadays finding out which intervention or which option has a value for money is vital, mainly due to the fact that investors and researchers focus on “presumed benefits” of health care research projects which makes it necessary for health research systems to consider costs and benefits of programmes or interventions (Yazdizadeh, Majdzadeh, & Salmasian, 2010, p. 1).

In an attempt to tackle the infectious and/or tropical diseases neglected by the world’s affluent, the World Health Organisation (WHO) in its first ever report on neglected tropical diseases “Working to overcome the global impact of neglected diseases” published in its weekly epidemiological report number 13 year 1986, said those diseases are endemic in about 149 countries, affect about 1 billion people worldwide and simultaneously threaten the health of million others. About 2.7 billion of the world’s poorest (i.e. those who live on less than US$ 2.00 per day) are said to be affected by at least one neglected tropical disease (WHO, 2011, p.113).

It is well-known that infectious diseases are rampant in developing countries due to financial disadvantage and this in turn makes co-infections common. This financial disadvantage makes the most vulnerable in the developing societies feel the adverse impact of infectious diseases partly due to the fact that they are unable to patronize any integrated health care service, prevention programme or even medicine. Infectious disease mortality has the most of its mortality victims hailing from developing countries of the world accounting for 15 million lives annually (Global Health Council, 2000).

However contraction of one infectious disease comes along with many other diseases, called co-infections. This is simply because once infected with one disease the vulnerability towards others diseases increases due to the weakening of the immune system of the affected. “For instance people infected with HIV/AIDS are more likely to become ill from tuberculosis or malaria” (Global Health Council, 2000). Infectious diseases with their co-infections definitely impair the health of adults as well as children; they may cause disability, decrease productivity, diminish quality of life or even cause death.

Research in the field of neglected infectious or tropical diseases has recently gained support from the realms of public, government and philanthropic organizations across the globe for the development of pharmaceutics against some of the neglected diseases (Moran et al., 2009, p. 143).

Diverse efforts are in no doubt needed to achieve the sixth Millennium Development Goal of stopping and reversing the spread of infectious diseases by 2015 (Global Health Council, 2000) hence the effort of the Bernhard-Nocht Institute for Tropical Medicine of Hamburg, Germany to go into a Public-Private partnership with a Swiss Foundation in an attempt to address this imminent problem. This cooperation led to the starting of a research project entitled “neglected infectious diseases as causes of morbidity and mortality in African children under five years of age – establishment of an advanced diagnostic system” in 2007 with the aim of establishing the WHO Integrated management of Childhood Illness (IMCI)-based diagnostic system for infectious diseases, as well as developing a simple clinical algorithm for the direction of patients to specific investigations and treatment schemes, assessing morbidity and mortality of Ghanaian children under five years of age due to invasive bacterial infections and their participation and role in various co-infections including malaria among other objectives (BNITM Hamburg, n.d.).

3 Disease in focus - sepsis

Sepsis is a blood infectious disease with a serious medical condition caused by an overwhelming immune response to infection. A widespread inflammation is triggered by the chemicals released into the blood to fight infection when patients are struck with sepsis. Sometimes blood clots during the disease hinders blood flow to limbs and other internal organs depriving them of oxygen and nutrients which may results in an organ damage in severe cases of sepsis. This is because in worst cases infections lead to a life-threatening drop in blood pressure called septic shock which can quickly lead to the failure of organs such as the lungs, kidneys and liver with fatal result. About 1-2% of in-patient admissions in the United States are afflicted with sepsis making up 750,000 people annually. Sepsis is often used interchangeably with septicemia, a serious and a life-threatening infection that worsens swiftly and often leads to death. In most Ghanaian health reports, statistics on septicemia is often covered but information on sepsis is absolutely neglected (WebMD, 2005).

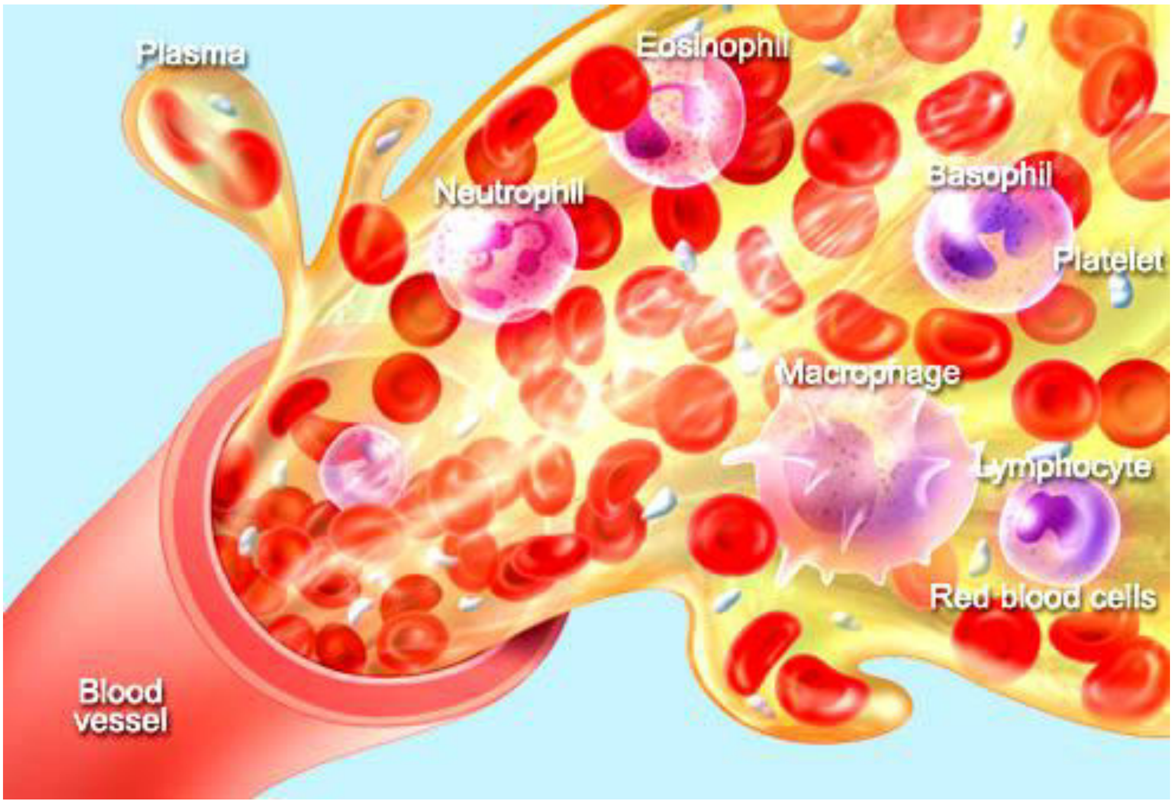


Figure 1: A picture showing a human anatomy and content of blood **Source: WebMD; LLC, 2010**

The disease is mainly caused by bacterial infections as well as other infections which can begin from any part of the body resulting from harmless conditions like a scraped knee, nicked cuticle or from a more serious medical problem such as appendicitis, pneumonia, meningitis or urinary tract infection. The bacteria are often contracted by hospitalized patients during through IV lines, during surgical incisions, urinary catheters and through bed sores. Sepsis could be a co-infection of a bone infection called osteomyelitis. Though anybody is at risk in getting sepsis, people with weaker immune systems due to illness, for example HIV/AIDs or cancer patients or even the usage of drugs that suppress the immune system for instance in preventing rejection of transplanted organs; very young babies, the elderly with other health problems, convalescing patients discharged from admission and people with diabetes are particularly at risk (WebMD, 2005).

There are diverse symptoms that could signal the contraction of the disease, for instance rapid breathing and change in mental status such as alertness or confusion may be the main signals for the beginning of the diseases. However other common symptoms such as diarrhoea, rapid breathing, rapid pulse, nausea and vomiting, decreased urination as well as fever or shaking chills or even a very low body temperature could be accompanying signals for sepsis. Once the sepsis is diagnosed there should be no delay in conducting a diagnosis, in the case of a suspected sepsis the medical practitioner should ask the biomedical personnel to run a test to establish the level of bacterial concentration in the blood sample of the affected patient or in other body fluids, a high or low white blood cell count, a low platelet count, low blood pressure, excessive acid in the blood called acidosis and altered kidney or liver function. Due to the higher cost of sophisticated microbiological diagnostic facilities in most part of Africa especially Ghana, some diagnostic procedures are very expensive that the local residents could not afford to take their children for treatment to those facilities. However the medical practitioner could also trace for the source of the infection by demanding a radiologic imaging such as X-ray, CT scan or ultrasound. In the case of severe sepsis diagnosis doctors should relocate patient to the intensive care unit (ICU) and try to stop the infection, keep vital organs functioning and regulate blood pressure (WebMD, 2005).

4 Research Setting

4.1 Ghana

The study was conducted in Ghana a West African country with democratic governance located on the Greenwich Meridian and only few degrees north of the Equator covering an area of 238,538 square kilometer or 92,100 square miles. The country is made up of ten administrative regions and 170 districts with Accra being the nation's capital and Ashanti being the second capital. Kumasi is the capital city of the Ashanti Region. The country has Burkina Faso on its Northern territories, Togo in the East and Cote D'Ivoire to the West with the Gulf of Guinea to the South (Department Of State, 2011).

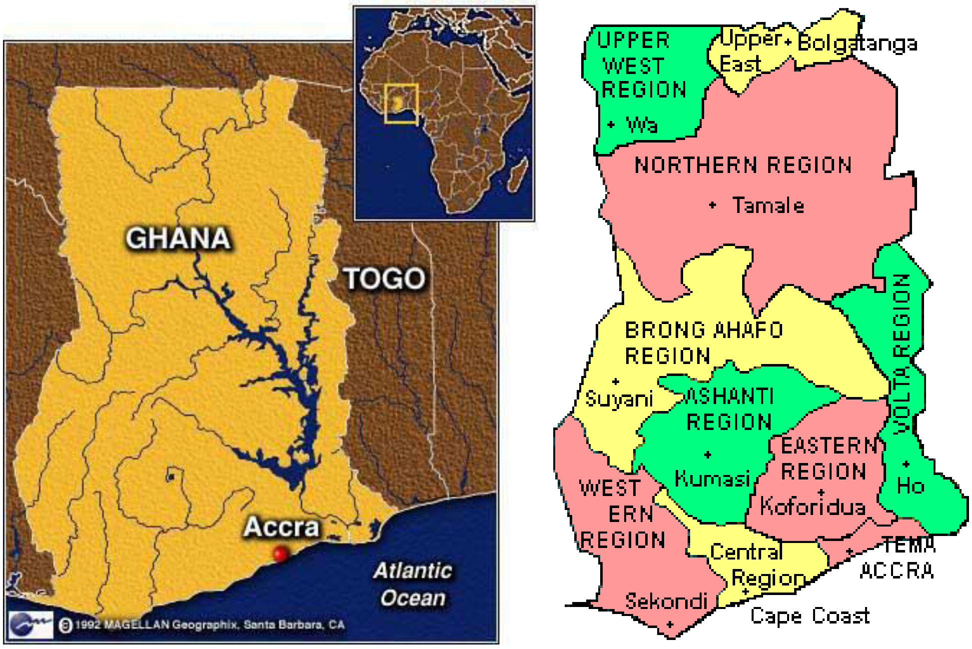


Figure 2: Map of Ghana showing geographical location in Africa and Regions of Ghana

The countries population now stands at 24 million as at year 2010 with an annual growth rate of 2.4 with life expectancy for the general Ghanaian population is 63.4 years at birth whereby women life up to 62.3 years from birth and male up to 59.8 years. Infant mortality rate is estimated in 2011 to be at 48.55 out of 1,000 live births (Department Of State, 2011; Ghana Government, 2012).

Out of the 11.1 million population in the workforce of the country, 47.9% are engaged in Agriculture and fisheries; 19.3% in sales and clerical; 16.2% in transport and industry; 8.9% in professional employments, 5.9% in services and the rest (1.8%) engaged in other sectors (Ghana Government, 2012).

Ghana currently has a GDP of 26.2 billion U.S. dollars with a growth of 4.7 U.S. dollars per annum.

The Ghana government's general expenditure on health as a percentage of total expenditure on health in 2009 was 53.2% whereas the per capita total expenditure on health at average exchange rate (US$) was 53 in 2009 (Department Of State, 2011; Ghana Government, 2012).

4.1.1 The Health System of Ghana

Before the implementation of the current national health insurance scheme in the country the Ghanaian population have to pay from their own pockets for basic health care in a health system popularly known as the "cash-and-carry".

However since the health system reform in year 2004, the old system whereby patients and care-givers alike have to pay directly out of their pockets for medical care came to an end for a majority of the Ghanaian population.

Figure 3: Sample of the NHIS membership care - front and back view

The financing of the current health system has been stipulated by the Ghanaian constitution Act 650 of the National Health Insurance Scheme (NHIS). The contributions to this scheme comes from 2.5% of the Ghanaian Social Security and National Insurance Trust (SSNIT) contribution of workers, 2.5% of Value Added Tax on all consumable goods purchased by the Ghanaian consumer as well as the Ghana Governments contribution to the scheme, returns from investment and premiums from subscribers (Ghana Health Insurance Authority, n.d.; NHIS, n.d.).

Anybody living and working in Ghana and qualifies to be covered must be registered then all the nuclear family members, meaning his or her children and spouse, will automatically be family insured. Patients or care-givers who accompany their children to any NHIS accredited health facility need not pay for any of the NHIS covered health services and drugs but only for those costs that fall outside the NHIS health service and medical coverage.

Any qualified person first registers by a nearby national health insurance agent and get the insurance card which is valid for one year after which it is renewed by payment of a fee. This card is then shown to the health service personal at any outpatient department (OPD) and the card detail is recorded on a NHIS database. The patient then receives all health services and drugs on the cost of the insurer, in this case, the National Health Insurance Authority (NHIA). The cost of all the service rendered to the patients including drugs cost is then channeled to the NHIA through the account's office of the health facility in question after which the insurer pays the health service provider.

4.1.2 National Health Insurance Scheme of Ghana (NHIS)

Ghana being one of the developing nations of the world has majority of its populace living under the poverty line and these less privileged have been, for many years denied access to a quality health care due to the Cash-and-Carry health care system of Ghana that controlled access of health care in Ghana. Cash-and-Carry simply means out-of-pocket payment to access health care, without prior payment at health facilities (hospitals, clinics, health centers and maternity homes) patients are obliged to suffer the pain of their health problems or even suffer death. This system has taken the toll of many lives that could not afford to pay for quality health care due to their social stance.

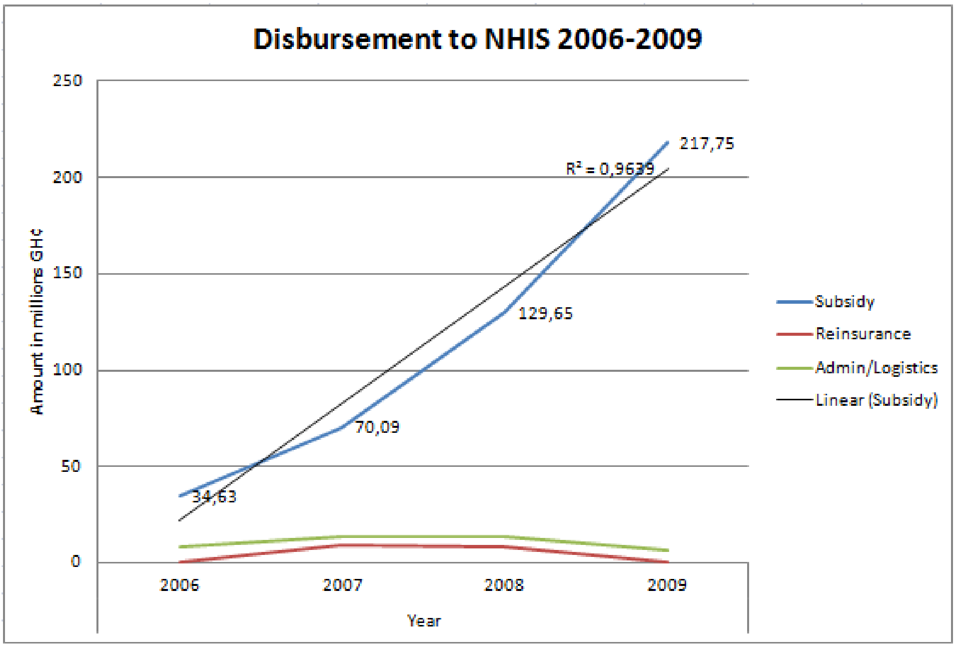


Figure 4: Trend of disburse to the NHIS from 2006 to January 2009 **Source: Ghana NHIA; Author's own design**

However the cash-and-carry system controlled for moral hazard as people only visit health facilities when they are sick. The system though marginalized the most poor in the Ghanaian society in seeking preventive health care but it allowed the government to provide free medical care for the older people above 70 years of age, children under 5 years, pregnant women's ante-natal care and all those under an exemption programme implemented the system's financing. Though the system required that some patients paid for health service provided, they are mostly expected to pay out of their pockets for drugs and some medical consumables whenever they visit any medical facility. The government bore part of the health service cost, in the cash-and-carry system, in that the state took all other cost including consultation, remuneration and salaries for health workers such as medical practitioners, nurses and paramedical staff in hospitals. This system survived till 2004 when the present health insurance system evolved (Ghana Health Insurance Authority, n.d.).

The previous governments of Ghana have made effort in making it possible to have a running health system but they were also relentless in searching for better options to ease the financial burden of the Ghanaian citizens to enable them have a universal and quality health care. This aim spurred the National Democratic Congress (NDC) to start with pilot projects of the NHIS in the Dangme West District in the Greater Accra Region and the Nkoranza District of the Brong Ahafo Region both in Ghana.

Though the NDC government could not implement the programme due to the fact the pilot project was conducted during its second term of office, it however laid the foundation for its follower – the New Patriotic Party (NPP). The new government under the NPP moved on to implement the tested healthcare financing system after taking office from the NDC government in 2001. The new health insurance system, code named the National Health Insurance Scheme (NHIS) was enacted by law under the National health Insurance Act, Act 650 in 2003 which pushed forward the establishment of the NHIS in 2004. The Health Insurance Act of 2003 however mandates the National Health Insurance Authority (NHIA) to regulate and implement the implement the scheme in Ghana (Ghana Health Insurance Authority, n.d.).

Figure 5: National health insurance education campaign

Three health insurance schemes are so far established by the NHIA: The District Mutual Health Insurance Scheme (DMHIS), Private Mutual Health Insurance Scheme (PMHIS) and Private Commercial Health Insurance Scheme (PCHIS). The sources of financing the scheme is purely through local efforts as directed by Act 650 0f the NHIS: The National Health Insurance Levy (NHIL), a 2.5% deduction from the Value Added Tax (VAT) collection and a 2.5% transfer from the existing Social Security and National Insurance Trust (SSNIT) contributions (Ghana Health Insurance Authority, n.d.).

Since its implementation, the NHIS has been able to cover about 95% of most of the diseases affecting the Ghanaian population. The following services rendered by health care and health service providers are covered by the NHIS benefits: Out-Patient, In-Patient and oral health services as well as maternity care and emergencies. The cost for general and specialist consultation, general and specialist diagnostic testing including laboratory investigation, X-rays and ultrasound scanning; drugs provided which are featured on the NHIS drug list; surgical operation for Hernia repair and physiotherapy incurred by patients or clients on their OPD visit are covered by the scheme. The In-Patient services covered by the scheme are general and specialist in-patient care, diagnostics tests, supplied prescription drugs on the NHIS medicines list, blood and blood products, surgical operations, In-Patient physiotherapy, accommodation in the general wards and feeding for patients or clients on admission are taking care of by the scheme. Oral health services such for pain relief and dental restoration such as tooth extraction, temporary incision and drainage as well as simple amalgam filling and temporary dressing are respectively covered as well. Maternity care such as antenatal care normal and assisted deliveries, caesarean sections and post-natal care are as well covered by the scheme. Services rendered in emergency such as medical emergencies, surgical emergencies, pediatric emergencies, obstetric and gynecological emergencies and road traffic accidents are considered by the NHIS (NHIA, n.d.).

Nevertheless other services are rendered by care or service providers that are not considered by the scheme. These costs are borne by the patients themselves out of their own pocket. Health care services that fall in this category include Echocardiography, Photography, Angiography, provision of HIV Retroviral drugs, cosmetic surgeries and aesthetic treatment, appliances provided such as optical aids, heart aids, orthopedic aids and dentures; assisted reproduction through artificial insemination and gynecological hormone replacement therapy; dialysis for chronic renal failure, organ transplantation; heart and brain surgery other than those resulting from accidents; mortuary services; diagnosis and treatment abroad; VIP ward accommodation; cancer treatment other than breast and cervical cancers; all drugs provided not featured on the NHIS list as well as medical examinations for the purpose of visa application, education, institutional, driver’s license application (NHIA, n.d.).

4.2 Ashanti Region

Two towns located in the Ashanti Region of Ghana were the main research focus partly due to their location in highly malaria-prone areas supported by the epidemiological data from the two major hospitals of the districts in which these towns are located.

4.3 *Pramso, Bosomtwe District*

4.3.1 Geographical location and economic status of the population

The Saint Michael’s Catholic Hospital is located in Pramso a sub-district township under the Bosomtwe District with Kuntenase as the district capital which is about 28 km (about 25 minutes drive) from Kumasi, the regional capital of the Ashanti Region. The hospital was established in 1958, shortly after the attainment of independence, by the Catholic mission which rendered health service to the inhabitants of the Bosomtwe District and those living around the Lake Bosomtwe area. With this the burden of the local residents in travelling far distance to Kumasi or the Bekwai Government Hospital to seek for health care came to an end. The district lies within latitude 6°43’ North and longitude 1°46’ West with a total catchment area of 718 km^2. The district has Atwima Nwabiagya and Kumasi Metropolis as its Northern neighbours, Ejisu-Juaben on its Eastern border and Amansie West and East Districts bordering it to the South (Bosomtwe District Assembly, 2006; Ghana Districts, 2006a; InterCare, 2010).

Though English is the official language widely spoken in offices and institutions, the local people predominantly communicate with health officials through the Asante (Twi) language. The hospital at Pramso is a Catholic Mission hospital but supported by the Ghanaian Government under the auspices of the Ministry of Health. The hospital serves a wide catchment area ranging from Kumasi, Dunkwa and the population living in and around the Lake District (Lake Bosomtwe) (Derbie, n.d.).

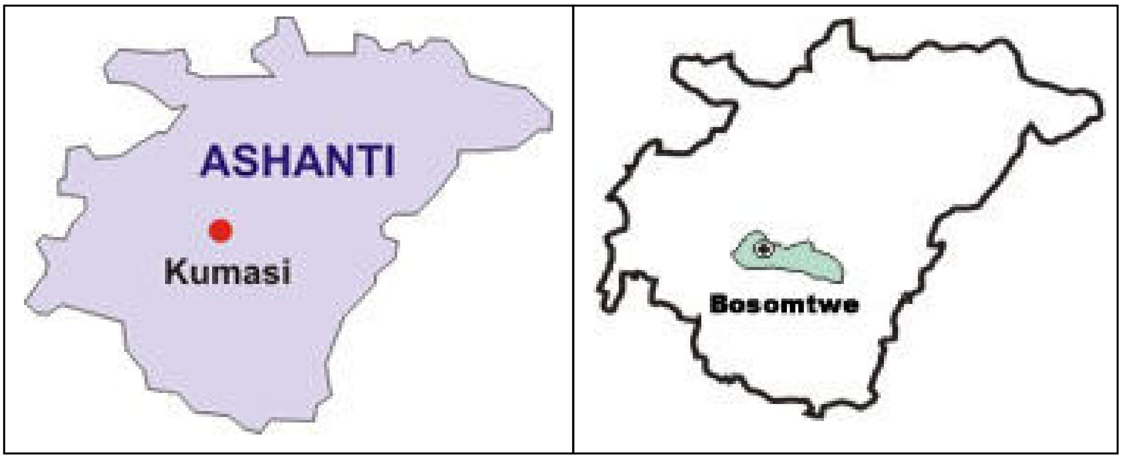


Figure 6: Map of Ashanti Region showing the Bosomtwe District

The 2000 population census (conducted prior to the separation of the Bosomtwe District from the Bosomtwe-Atwima-Kwanwoma District by law LI 1852 in 29th February, 2008) estimated the total district population to be 146,028 with a 49.2% comprising male and 50.8% being female. Compared to the Ashanti Regional total population, the former Bosomtwe Atwima-Kwanwoma (BAK) District has a 4% share of total inhabitants in the region. The estimates after carving the Bosomtwe District from the former BAK District in 2008 showed that the total district population stands currently at 99,964 inhabitants with most of the population 34,681 (35%) residing in the district capital Kuntenase. The Kuntenase Government Hospital happens to be the current district hospital since the reorganization of the Bosomtwe district in 2008. Pramso follows with a population of 24,638 (25%), Jachie with 24,324 (24%) and Amakom with 16,321 (16%) with an increasing tendency (Boakye, n.d.). The population density of the district has been increasing over time with reference to 52 persons living per square kilometer in 1984 to 128 persons in 1994. Most households are of the extended family type with families and their relatives all living together on the same compound. The average household size is 8. Children under aged 14 years or younger and adults aged 65 years or older depend on the working population. The dependent population of the district amounts to 75,618 (51.7%) and the working population being 70,410 (48.3%) of the 146,028 district population with a dependency ratio estimated to be 0.8:1 which looks favourable but the fact is most working age population are unemployed. The higher unemployment level of the working population has lead to an economic dependency ratio of 0.76:1 meaning there is a potential for savings that can lead to investment and job creation in the district. The agriculture sector engages more workforce than other sectors. There is about 62.6% of labour force working in the agriculture sector, 19.1% working in the service sector, the industrial sector engages about 16.7%, with trading sector engaging 11.31% of the labour force in the district. Women dominate the trading sector trading with mostly industrial hardware (56%) purchased in Kumasi. Seasonal or disguised unemployment is around 4% under the working age group. The major part of the income earned into a household is spent on food.

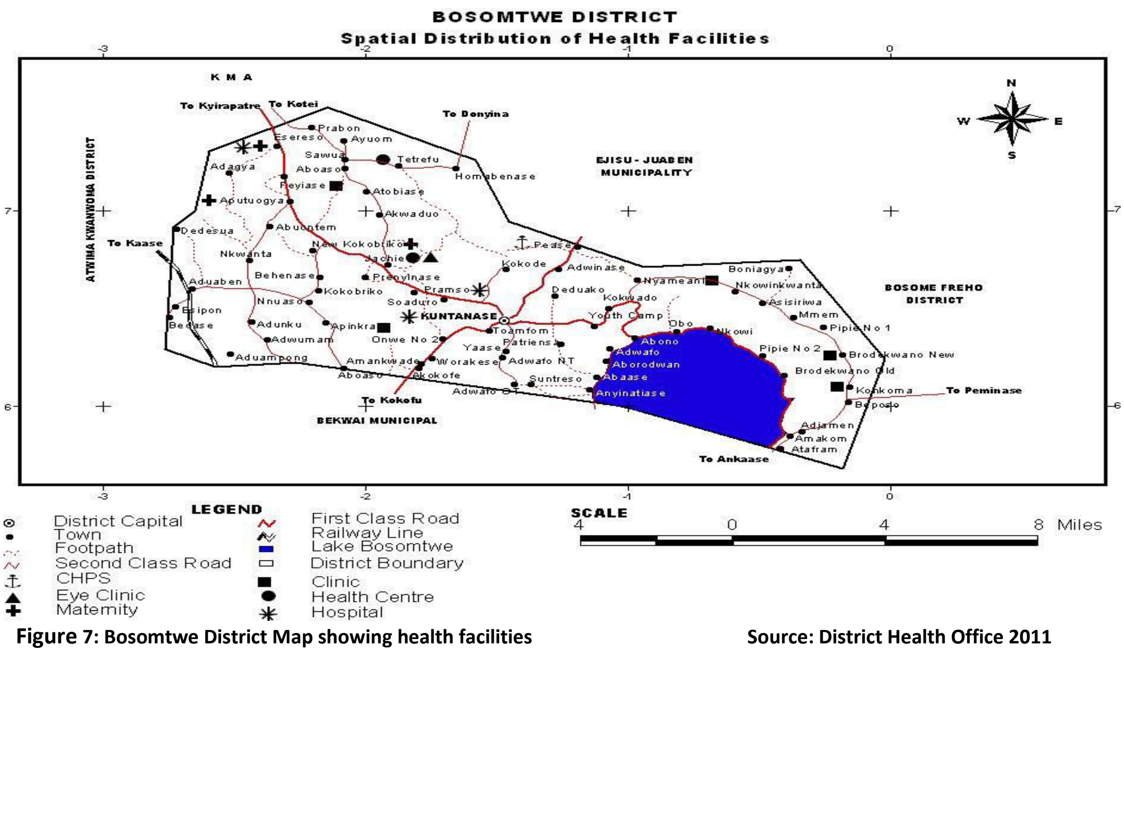


Figure 7: **Bosomtwe District Map showing health facilities** **Source: District Health Office 2011**

Those working in the industrial sector earn the most with a monthly income of ¢56,547 old Ghana Cedi (US$ 3.6), whereas those working in the farming and trading sector earn around ¢49,276 (US$ 3.2) and ¢49,494 (US$ 3.14) old Ghana cedi respectively in per month. The average monthly income for households in the district was estimated to be ¢73,983 (US$ 4.8) old Ghana Cedi (equivalent to GH¢ 7.4 Ghana New Cedi) per month implying a ¢14,796 (US$ 9.7) old Ghana Cedi per capita per month for each individual residing in the district. It is interesting to note that out of the 39,220 pupils enrolled in the basic schools in the district 21,182 are girls and 20,099 are boys (Ghana Districts, 2006a & Bosomtwe District, 2006).

It is worth noticing that the climate under which the St. Michael's Catholic Hospital is located favours infectious diseases especially malaria. This is because the Bosomtwe District falls within the equatorial zone with a double-maxima rainfall typical of the moist semi-deciduous forest zone of Ghana meaning trees in this forest zone loses their leaves at some point in time. The first rainy season begins in March through July with a peak in June whilst the second season begins in September through November peaking in October. The combination of the climatic condition and the vegetation serves as a motivating factor for mosquito breeding within the district. Due to the fact that the district has a lot of irregular stream branching and tributaries joining a main stream from all angles in other words having a dendritic nature, the district does not have any highland with the exception of the area around the lake Bosomtwe which stands at an elevation of 50 to 80 m high (Ghana Districts, 2006b; Bosomtwe District, 2006).

The district has extensive forests with wood species such as "As Mahogany" and "Wawa". Crop farming also take place in the forest which provides employment for about 53% of the population. Most of the population use fuel wood obtained from the forest as their main source of energy (Bosomtwe District, 2006).

4.3.2 Health facilities, resources and finance

Before the separation of the Bosomtwe district from the Bosomtwe-Atwima-Kwanwoma district in 2008, the old district office of the Ministry of Health said 26 health facilities were known in the district as at 2005 with all of them having either of the following operators: public, private or mission. Only the St. Michael's Catholic Hospital, Divine Mercy Hospital and the Kuntenase Government Hospital have attained the hospital status with the rest of the health facilities being clinics, health centers and maternity homes. The physician-patient ratio stood at 1:21,884 with a total number of 167 health personnel for the entire district (Ghana Districts, 2006a).

The situation changed over time as the St. Michael's Catholic Hospital alone has 8 medical officers and 84 health and paramedic assistants comprising of community health nurses, midwifes, Rotational and State Registered Nurses (SRNs) (Ghana Districts, 2006c).

The hospital had 99 beds with a pediatric ward, male and female wards, maternity and nutrition ward, laboratory department, records and statistics department, pharmacy department, X-Ray department, ophthalmology clinic, HIV/AIDs clinic. Moreover the hospital has a mobile clinic that visits the nearby villages once a month to give maternal health care and general consultation coupled with a support from visiting specialists in pediatric surgery, ophthalmology and obstetrics. Once the pharmacist in charge, Mr. Eugene Owusu Afriyie, said "the hospital at Pramso attends to 450 patients per day being the only one in the district. Because of good healthcare delivery, clients (patients) from the nearby city, Kumasi come all the way for healthcare…" (InterCare, 2010).

Though a number of traditional herbalist are in operation in the district but no concrete information about them could be given by the district office.

4.4 Agogo, Asante Akim North District

4.4.1 Geographical location and economic status of the population

The Agogo Presbyterian Hospital is the oldest mission hospital in Ghana dating back to the 1930s. It was established on the 21st of March, 1931. It is located in the Asante Akim North Municipality with a population of 170,882 inhabitants (Agogo Presbyterian Hospital, 2010a).

The Municipality is located in the eastern part of the Ashanti Region between latitudes 60°30’ and 70°30’ North; as well as on longitudes 00°15’ and 10°20’ West with a catchment area of 1,160 km^2. The Municipality shares boundaries with Sekyere East on the North, Kwahu South on the East, Asante Akim South on the South and Ejisu-Juaben Municipality on the West (Asante Akim North Municipal Assembly, 2006).

A survey conducted from the 19th of January, 2006 to 22nd February, 2006 by a Canadian intern through a partnership between the National Association of National Authorities (NALAG) and the Federation of Canadian Municipalities (FCM) shows that, on average 5 persons live in a household

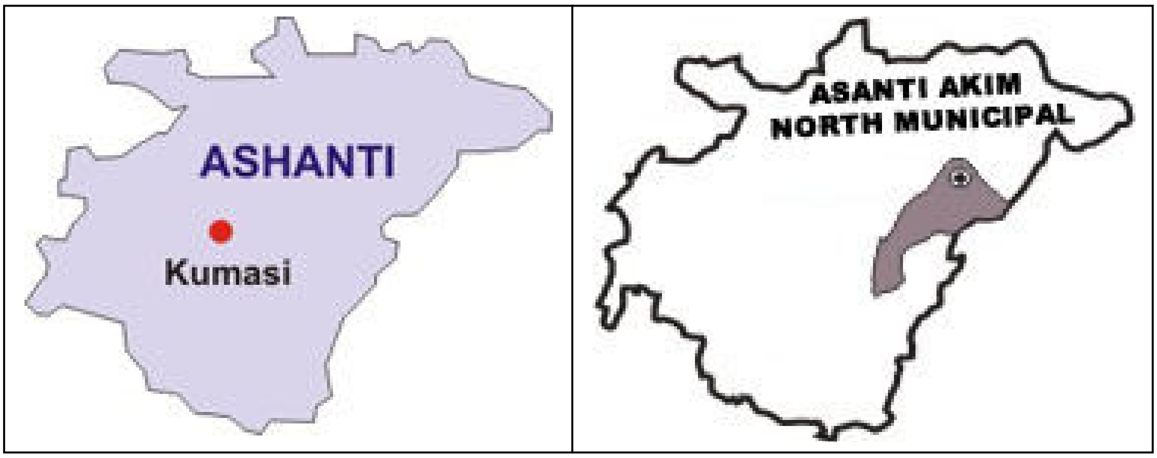


Figure 8: Map of Ashanti Region showing the Asante Akim District

with an average of 2.0 rooms for the entire household in the Municipality. The main source of drinking water is boreholes though some households have access to tap water. The household expenditure per month lies at an average of ¢1,180,000 old Ghana cedi (equivalent to GH¢ 118 Ghana New Cedi) with more than half of it spent on food but education and health consumes the most part of the monthly expenditure left. Gender disparity does not play a major role in who leads a family or household as its head in the municipality since on average 48.5% of males make up family heads whilst 54.5% of females constitute family or household heads in the municipality (Ghana Districts, 2006a).

Though English is among the secondary languages spoken in the municipality only 31.9% of the total district population do use it. Majority of the population in the municipality speak primarily local languages with 96.3% speaking the Asante (Twi) and those speaking Ewe making up 1.3% of the total district population. The rest of the primary languages spoken in the municipality are Ga, Fante and Dagbani. Though the hospital at Agogo serves a large number of the population it is not the district hospital but rather the Konongo Government Hospital (Asante Akem North Municipal, 2006).

The municipal population, according to the Ghana Statistical Services, stands at 126,477 in the year 2000 and was estimated to reach 169,976 in year 2010. Females outnumber the male population in the municipality forming a 54.6% of the population. Christianity is the main religion of the population forming 93.5% with a minority of a Muslim population making-up 1.6%, 0.4% Traditionalist, and 0.8% claiming belonging to other religions with 3.7% having no religion. About 96.3% of the people communicate in the Asante (Twi) language with English being predominantly spoken as the second language of choice (Ghana Districts, 2006a).

Farming engages most of the working force in the municipality aged 15 years and above comprising of 53.9% of all occupations. Significant number of people are engaged in trading (16.3%), vocational services (13.1%) such as hairdressing, sewing and driving. Labour (thus carpentry, masonry, etc) and professional occupations (thus teachers, pharmacists, etc.) constitute 6.5% of the workforce. It is however interesting to know that about 83.3% of children between ages 4 and 15 go to school but unfortunately the non-attendance rate is higher under females than males rating from 12.0% and 9.6% respectively (Ghana Districts, 2006a).

The Asante Akim North municipality is characterized with semi-deciduous open forest that covers the highlands in an area of 575 m^2 and a closed forest covering an area of 230 m^2. The municipality witnesses double maxima rainfall typical of most parts of Ghana which occurs in July and November with the first rainy season observed from May to July and the second from September to November each year. The mean annual temperature of the area is 26°C which coupled with the vegetation and climatic condition provides a suitable atmosphere for the breeding of mosquitoes (Ghana Districts, 2006d).

4.4.2 Health facilities, resources and finance

The Asante Akim North Municipality has five sub-districts, each with its unit heads and sub-district of which Agogo happened to be part. The municipality has 12 operational health facilities rendering service to about 154, 574 population. Seven of the health facilities are operated by the public and five by private organizations or individuals (Ghana Districts, 2006e).

There are however a number of alternative medical practitioners (traditional health service providers) in the municipality though not well organized but considered as part of the health service system to render a complementary or stand-alone therapy for some spiritual, mental and physical dis-eases. These alternate practitioners have been given license to practice and pay tasks (Ghana Districts, 2006e).

Community based surveillance (CBS) are conducted by volunteers trained by the Municipal Health Management Team (DHMT) in the communities based in the Afram Plains (north) since the communities in this area are deprived of the access to major health facilities. Most of the health facilities are based in the south. The volunteers are trained “to detect, educate and inform health information staff” of any outbreak in the communities. Coupled to this are the Traditional Birth Attendants (TBAs) trained to make health care easily accessible by clients or patients in their homes (Ghana Districts, 2006e).

The Presbyterian Hospital of Agogo is one of the renowned hospitals in Ghana in diverse services in health especially in eyes treatment. Many clients come from all over the neighbouring countries like Togo, Burkina Faso and Cote d’Ivoire for general consultation particularly for ophthalmological care. The Agogo hospital has 404 health service staff which includes 19 doctors. The number of other staff amounts to 385. Among the doctors are seven specialists, two senior medical officers, two medical officers, two residents and six house officers. The rest of the staff are three medical assistants, five Anesthetist assistants, eighty-eight general nurses (22 on orientation), nineteen midwives, two Pharmacists, seven Biomedical Scientists, two X-Ray Technical Officers, one Physiotherapist and two hundred and thirty-eight other paramedical, administrative and service staff. The Agogo Presbyterian Hospital has 250 beds of which 233 are currently in use (Agogo Presbyterian Hospital, 2010b).

The hospital has the Inpatients Department (Wards) which has the following sub-wards: Medical Ward separately for male and female with 14 beds; Children’s Ward with 50 beds; Ward “U” (for Ulcer patients) with 20 beds; Eye Ward (for male and female) with 28 beds, Isolation Ward (for highly contagious disease patients like TB) with 9 beds; Casualty Ward with 29 beds; Special Ward (Ward “A”) with 3 beds; Intensive Care Unit with 6 beds; Nursery with 7 beds and Labour Ward with 8 beds. The Outpatients Department (OPD) has 4 consulting rooms each separated into two for two doctors but the Eye Clinic of the hospital also has its own OPD with four consulting room with an optical wing. There is also an operating theatre and a Pathological and Research Laboratory (Agogo Presbyterian Hospital, 2010b).

5 Original Clinical Project

This work was conducted as an adjunct evaluation of the already implemented project entitled "neglected infections as causes of morbidity and mortality in African children under five years of age – establishment of an advanced diagnostic system" by the Department of Infection Epidemiology of the Bernhard-Nocht Institute for Tropical Medicine in Hamburg. Though part of the core objectives of the study to undertake an economic assessment of the project, it took seven years to realize this goal. In the quest for examining the input and the output of the above mentioned study, an economic assess was necessary hence the planning on how to realize this aspiration of the Bernhard-Nocht Institute.

There is no doubt, that research in the computer age needs much to be desired coming with diverse challenges and demands hence the need for a proper planning and management tool to coordinate all the processes involved in any scientific enquiry right from planning to evaluation. Through mind mapping with the initiators of the original clinical investigation of the Infection Epidemiology Department, major objectives for the projected economic evaluation was arrived including and practical steps suggested in an effort to achieve the set objectives.

5.1 Setting up an Economic Research Project

From the onset, the demand of the Department of Infection Epidemiology was considered and their aims for eying the economic analysis were integrated in the planning phase of this work. Upon deliberating on the fact that the institute will like to know the impact of their implemented microbiological diagnostics system at the Presbyterian Hospital at Agogo in the Asante Akim Municipal Assembly of the Ashanti Region of Ghana; there was the need to also examine the impact of the existing standard diagnostic systems. This way the comparison of conventional and standard diagnostic systems is possible.

Upon reviewing literature, a cost effectiveness analysis was eyed to be able to come out with the desired results and in doing so since the input (costs) and the effect (benefits) were the main keywords in question, a cost-benefit analysis was selected as tool for embarking on the inquiry.

However this work is take economic inquiry, diagnostic systems, neglected infections, children in African under the age of five into consideration.

However this research is sought to investigate whether care-givers of sick children are in the position of paying for the health care of their wards as well as which of the two diagnostic systems help in detecting neglected infectious diseases.

5.2 Project Timeline and Milestones

The planning phase of the project started from the first week of September 2010 and purported to be completed latest mid-August 2011 but the postponement of my field trip to Ghana from the first week of January 2011 to the first week of February 2011 changed the roadmap for this study. The project timeline included kick-off meeting, literature review, tool analysis, instrument design, meeting and discussing for status report, travel to Ghana, field assessment, secondary data collection, sample selection of study subjects, administration of questionnaire, designing of analysis mask, data entry, data exploration and cleaning, return to Germany, preliminary analysis and report, further data analysis, final report writing as thesis and presentation of findings.

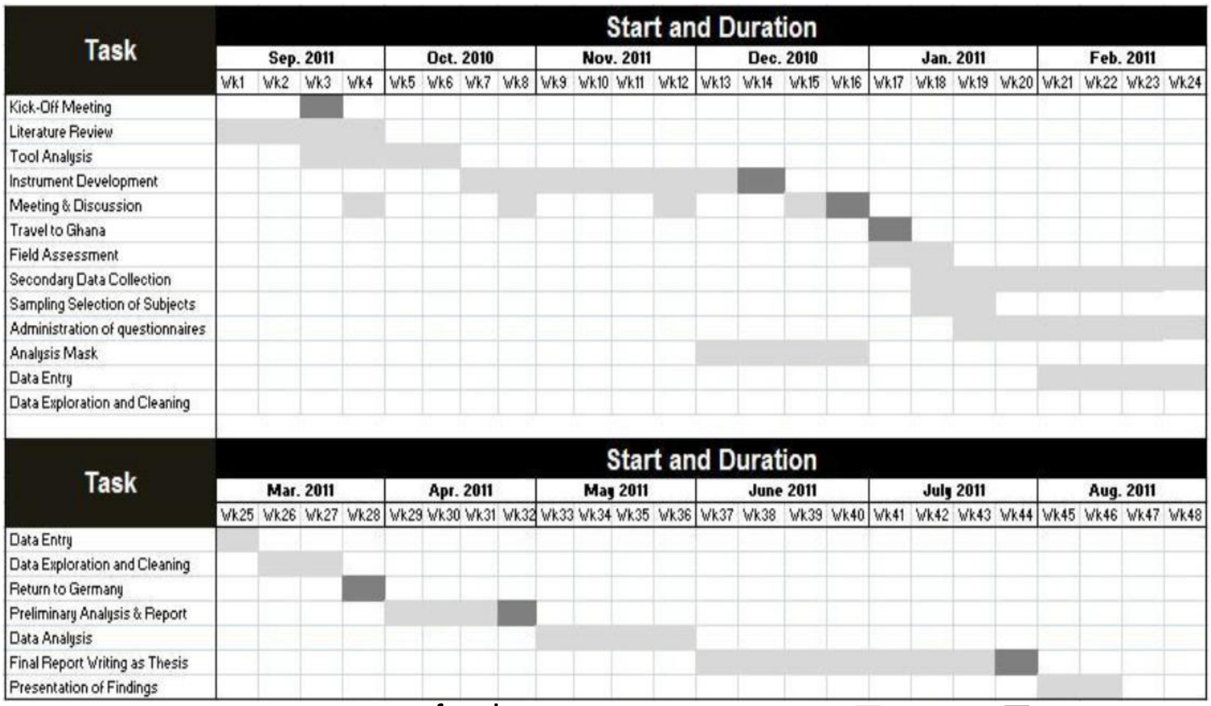


Figure 9: Gantt chart showing the old schedule of work

Legend: Timeline estone

The economic evaluation was conducted in two phases: first the internship part and secondly the practical part. The internship part involved literature search and kick-off meeting from the 1st through 4th week of September, 2010 and the 3rd week of the same month respectively. Upon completion of the literature review a search for a suitable economic evaluation tool was conducted from the 3rd week of September 2010 through the 2nd week of October 2010 with the final decision to employ the Cost-Benefit-Analysis (CBA) and the Incremental Cost Effectiveness Ratio (ICER) since the latter contains the measurement of the effectiveness of a programme in Quality Adjusted Life Years (QALYs) which combines two vital features in one metric indicator: the effects on survival measured in terms of life years and the effects on quality of life (Gray, 2011, p. 9). An appropriate and reliable tool was achieved by collating all the instruments to create a unified instrument that captures all the vital indicators of the study for the data collection. The "instrument development" took place from the 7th week to the 14th week on the programmed schedule. A series of meetings were held to brief the project coordinator, Prof. Dr. Jürgen May, on the stance of the study at the last week of each month from September 2010 which ended at the last week of January 2011. There was a little diversion in the planning as the journey to the field was delayed from the first week of January to the first week of February 2011. Upon arrival to the field the research setting was assessed within the first two weeks of February 2011 and the necessary preparation and adjustment of the instruments conducted to make sure the instruments are in conformity with the culture and understanding of the local people and the consent of the local authorities sought to ensure their support and cooperation. The field assessment involved reviewing of secondary data sources of the two settings, St. Michael's Catholic Hospital at Pramso (Pramso Hospital) and the Presbyterian Hospital at Agogo (Agogo Hospital), and interacting with the local health authorities. After the field assessment, subjects who qualified for inclusion in the study were included based on the informed-consent of their parents or guardians. The administration of questionnaires begun in the 2nd week of March at the Pramso Hospital and ended at the 2nd week of April, 2011 after which the same was conducted at the Agogo Hospital from the 2nd week of April to the 2nd week of May 2011. To make work easier, an analysis mask matching the instruments developed was designed through December 2010 but was adjusted while on the field in Ghana since some of the items on the instrumented needed to be added or revised. Data entry started right after completing the secondary data collection from the Pramso Hospital and this continued to the end of the primary data collection at Agogo Hospital. Basic data exploration was done while in the field and furthered upon return to Germany on the 26th May, 2011. Though the researcher had originally planned a return to Germany in March 2011 this changed to May 2011 due to late arrival in the field and problem in data access.

However a preliminary report on the Pramso Hospital was prepared and presented at the BNITM Hamburg in the 3rd week of June 2011. From August 2011 to January 2012 the data was analyzed and the final report written.

6 Methodology

6.1 Study design and research approach

A longitudinal hospital survey was employed to follow-up clients or patients under five years of age who report to the Out Patient departments (OPDs) of the two hospitals under study. Cost analysis was conducted at both health facilities to possibly identify the possible angles of cost, and cost to parents or guardians, cost to operators and cost to sponsors were identified.

A selection criterion was designed to pick every fifth child who reports to the hospital OPD being of age five or younger after which the child is further screened by the inclusion criteria, thus any child showing clinical symptoms of malaria with body temperature above 37.5°C or manifesting symptoms of suspected sepsis admitted to the pediatric ward are included in the study. Before inclusion an informed consent was read out to the parent or guardian of the study participant and upon agreement to allow the child participate in the study socio-demographic, clinical and economic data as well the subjective rating of the parents were collected from the first day on admission and a daily follow-up done to collected data on some of the indicators whereas some of the data are collected upon discharge or when any outcome is registered.

Patients who qualified after screening for the selection criteria were further screened for inclusion in the study upon informed-consent has been agreed on my parents or guardians. Study participants were monitored from the period of admission to discharge and followed up on daily basis and data on vital indicators regarding cost and health outcome collected.

Parents' or guardians' willingness to pay (WTP) was assessed and Time-Trade-Off (TTO) employed to assess the ratings of parents for their children's health on a scale ranging from one to ten. A satisfaction survey was also conducted for laboratory personnel to evaluate their level of satisfaction with the laboratory devices and salary. Afterwards QALYs or the effects of treatment with the aid of laboratory diagnostics were calculated from the TTO scores of parents or guardians. Furthermore a net benefit analysis was used in calculating the value of money for the diagnostic systems under study.

Databases such as PubMed, Center for Reviews and Disseminations (CRD), SpringerLink as well as websites of Ghana Districts were consulted for relevant information, articles or books relating to this work. SPSS Statistics 17.0 August 23, 2008 release and Microsoft Excel 2007 were employed to do the data analysis.

Univariate and multivariate analysis were conducted on data collected for both hospital datasets and economic analysis conducted.

Gantt chart was employed as the management tool for this study which kept the researcher on focus in achieving the objectives of the study.

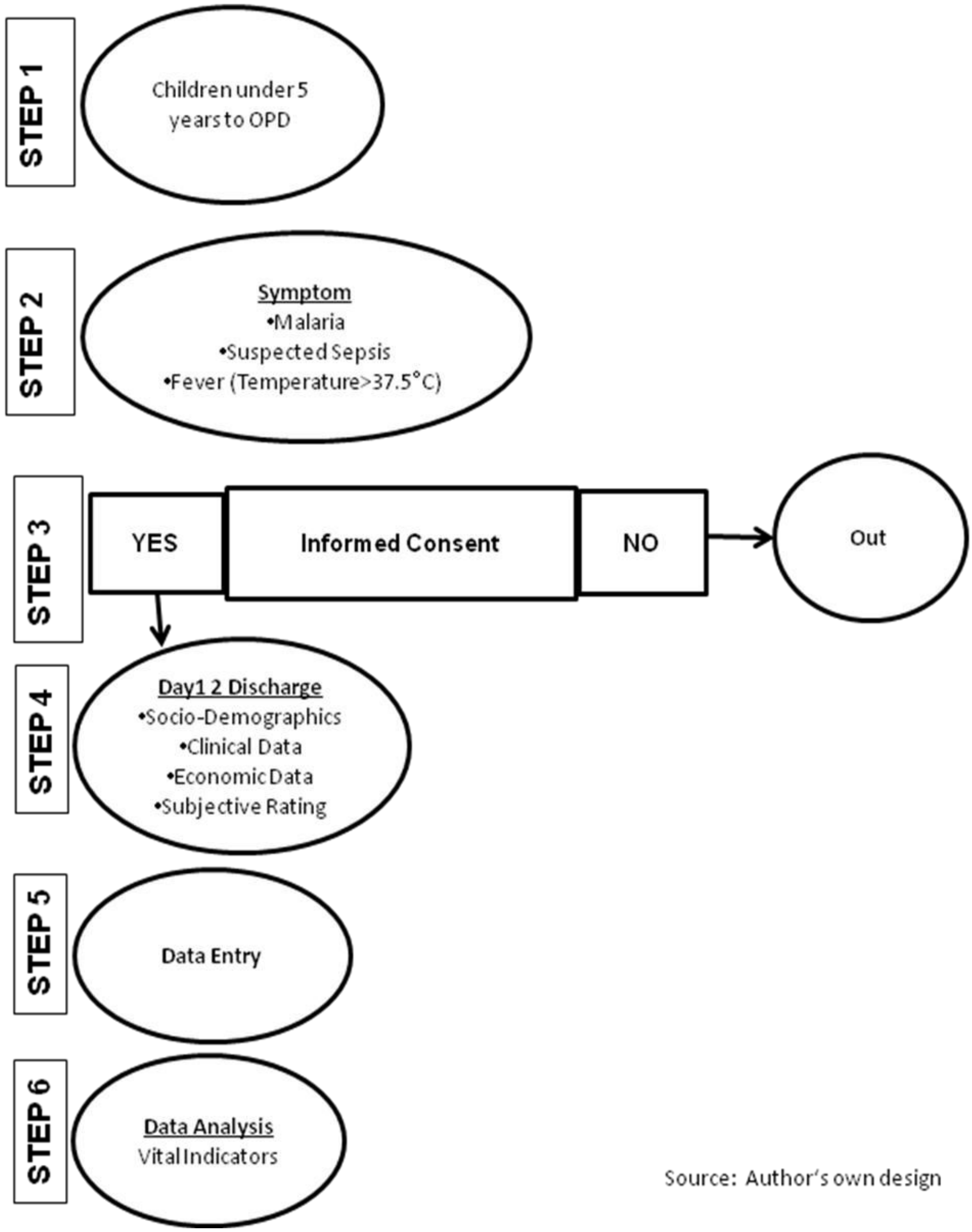


Figure 10: Diagram showing the methodology employed for data collection

The above diagram was used as the guiding protocol for recruiting and including of target population in the study. At step 1 children who are 5 years or younger from all the children who were brought to the children ward of the two hospitals were selected. Afterwards they were then screen at step 2 for the clinical symptoms of malaria, suspected malaria or fever with malaria (thus body temperature more than 37.5°C).

At step 3 there care-givers (parents or guardians) of the children were then informed about the study with its objectives and data protection guidelines were read out to them or they were made to read themselves (where they wish to do so). If they then wish to allow their ward to participate the child is then included in the study otherwise they were excluded. Those whose care-givers agreed to allow their ward to participate, in step 4, the children were then screened from baseline (day 1 in admission) to discharge for socio-demographic data, clinical data, economic and subjective rating. In step 5 data was entered and cleaned for outliers after which the analysis was then conducted in step 6.

6.2 Calculation of Quality Adjusted Life Year (QALY)

To assess the health utility attained by patients in the study, a Time-Trade-Off (TTO) approach was employed were care-givers (parents or guardians) were made to make a choice of assumed pain-free days during the acute painful days of malaria or infection on a visual analog scale ranging from day 1 to day 10. Afterwards each TTO value was then divided by 10 to get the TTO score which is then multiplied by the life expectancy in the health condition under question of the patient to get the QALYs needed.

In other words the utility or QALY weight u (Q) from 0 to 1, implying death and normal health condition respectively were calculated for each patient in the study. Afterwards the utility value was then multiplied to the period of time each patient spent in the health condition T. So therefore lifetime health profile of the patients is given by the summation of all the health utilities in the patients' health condition Q_i multiplied by the period of time spent T_i.

Hence the usage of the following formular:

$QALY = \sum_i U(Q_i) \times T_i$ eq1

Where T_i is the period of time spent in the given health condition Q_i.

6.3 Calculating Net Benefit

To assess the monetary value of the diagnostic system in question, the Net Benefit Analysis is employed as it is the suitable method under Cost Benefit Analysis in investigating the value for money of a single diagnostic facility.

To evaluate the value for money of the diagnostic system, then total cost (TC) of the diagnostic system is subtracted from the total benefit (TB) of it all in monetary terms.

$NB = \sum_i TB - \sum_i TC$ eq2

If the value for the net benefit (NB) results in a positive outcome, then one can conclude that the diagnostic system has a value for money and for that that matter affordable to the local population. However a negative outcome will imply that the system has no value for money or in other words is too expensive for the local people to bear.

6.4 Ethical Issues, Ethical approval and Data Protection

On moral grounds, all research intentions demand an ethical approval but those dealing with minors or children need to be well scrutinized and the motives behind assessed for the wellbeing of the children involved in any study as well as that of their parents or guardians.

Ethical approval for the main clinical trial was sought which covered the subsequent economic evaluation that will be conducted in the near future from the ethical commission of the Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, the capital of the Ashanti Region of Ghana. For this reason parents or guardians of study participants were first informed about their right to quit the study should they at any point feel their privacy is at stake and were rest assured of the fact that their data will be dealt with according to the data protection act of Ghana and that the study is strictly anonymous and not even the researcher will know the names of the participants but a trusted principal nurse of the pediatric ward. All questionnaires were analyzed with an attached questionnaire code which gave no clue of the participants' name.

7 Analysis

7.1 Pramso Hospital

7.1.1 Descriptive Statistics

Most care-givers take their children to the Pramso Hospital within the first two days after observing a symptom. The average age of the patients included in the study at Pramso Hospital was 2 years of age and stay on average 4 days in the admission ward. Parents or care-givers pay on average GH¢ 39.00 New Ghana Cedis (US$ 22.7) for treatment drugs, cost laboratory investigation and transportation to the hospital.

Table 1: Statistics of vital indicators for Pramso Hospital

	N	Minimum	Maximum	Mean	Std. Deviation
page_real	66	,50	5,58	1,6578	1,15175
Day(s) symptom began	57	1	6	2,02	1,217
Duration of hospital stay (days)	68	1	13	4,15	2,261
Distance from home to the hospital (min.)	56	0	180	58,27	38,601
Cost of trip from home to hospital (GH¢)	63	,00	8,00	1,2921	1,24930
Parents willingness to pay for ward's treatment (GH¢)	64	3,00	15,00	8,6094	5,04619
Cost of samples taken in admission (GH¢)	68	0,00	0,00	0,0000	0,00000
Cost of treatment drugs in admission (GH¢)	68	6,70	183,50	39,4015	33,10713
Cost borne by parents due treatment	63	10,20	117,60	36,7603	23,17387
Estimated weekly household income (GH¢)	59	1	6	3,59	1,069
Assessment health condition	65	1	10	3,06	2,098
Valid N (listwise)	41				

The cost of treatment alone is on average GH¢ 37.00 New Ghana Cedis (US$ 21.66). On average care-givers or parents take an hour in transporting their children to the Pramso Hospital paying lorry fare of GH¢ 1.00 (US$ 0.59) on average. Parents who accompanied their children to the Pramso were willing to pay on average GH¢ 9.00 New Ghana Cedis (US$ 5.27) for the laboratory analysis of their children's samples although they earn an average of GH¢ 4.00 New Ghana Cedis per week making GH¢ 16.00 New Ghana Cedis (9.37) per month.

Predominantly the patients who participated in the study were males (60% [39/65]) with females making up 40% (26/65). With 44.6% (29/65), children under one year of age make up the large age category under the study population followed by those older than a year but less than or equal to 2 years of age (29.2% [19/65]). However not much percentage margin, those children older than 2 years and lesser than or equal to 5 years make up 26.2% (17/65) (see figure 12 and figure 12 below).

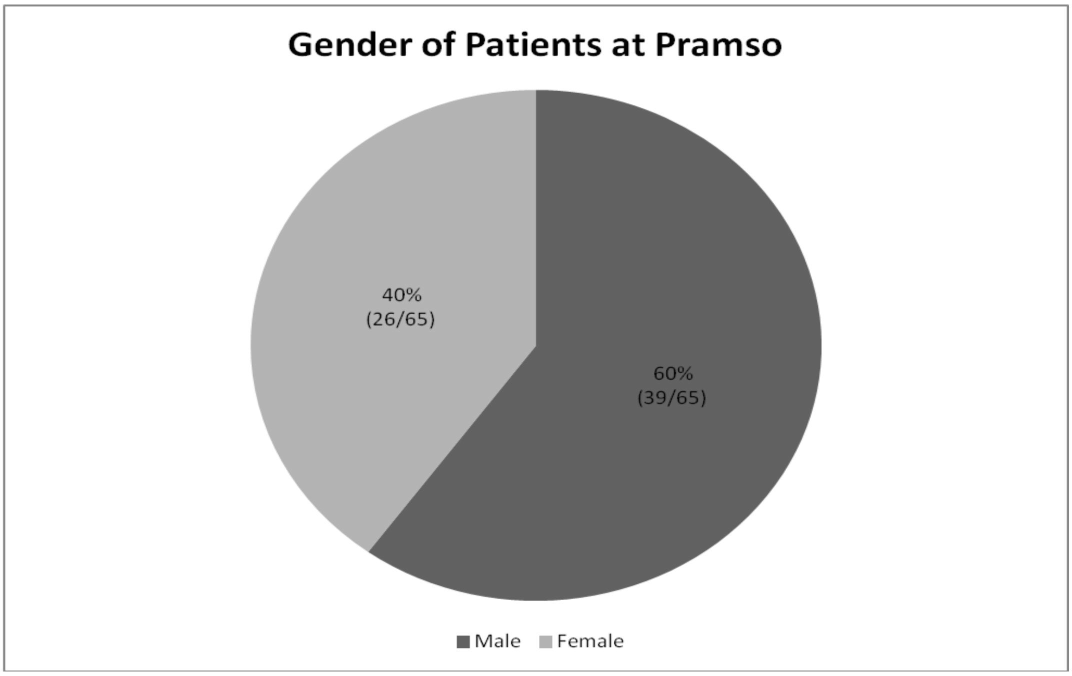


Figure 11: Gender of patients at Pramso Hospitals

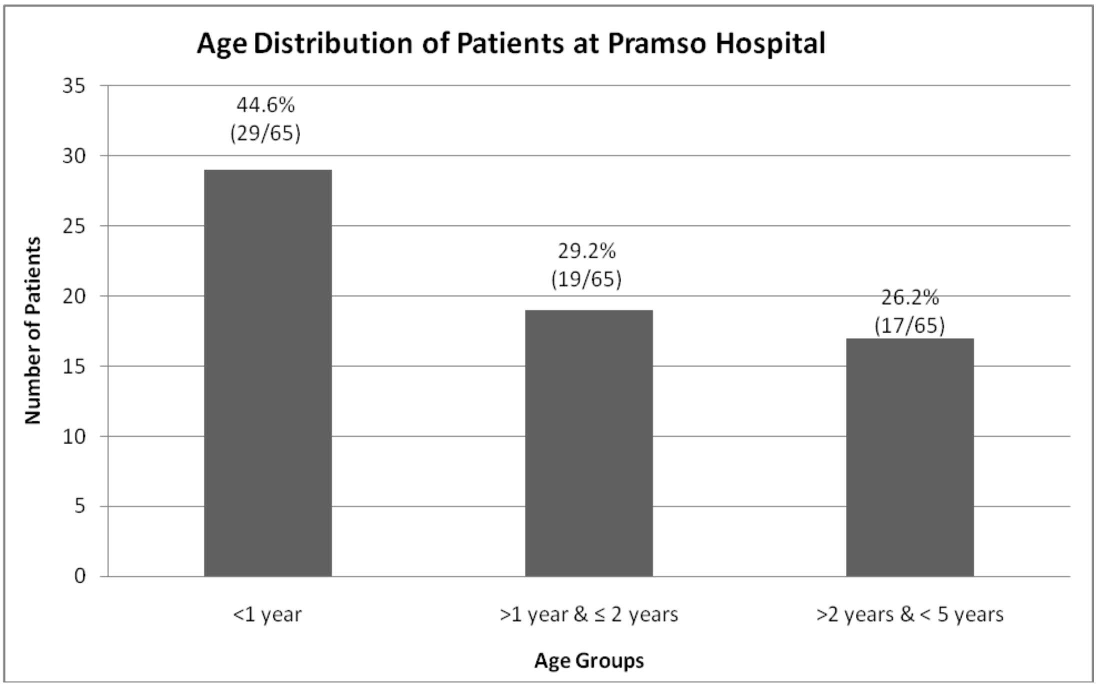


Figure 12: Age distribution of patients at Pramso Hospital

Most of the patients (66.7% [38/57]) in the study were brought to the Pramso Hospital within the first to second day of symptom manifestation as displayed in the diagram below with most of the care-givers (69.6% [39/56]) travelling more than 30 minutes to the hospital.

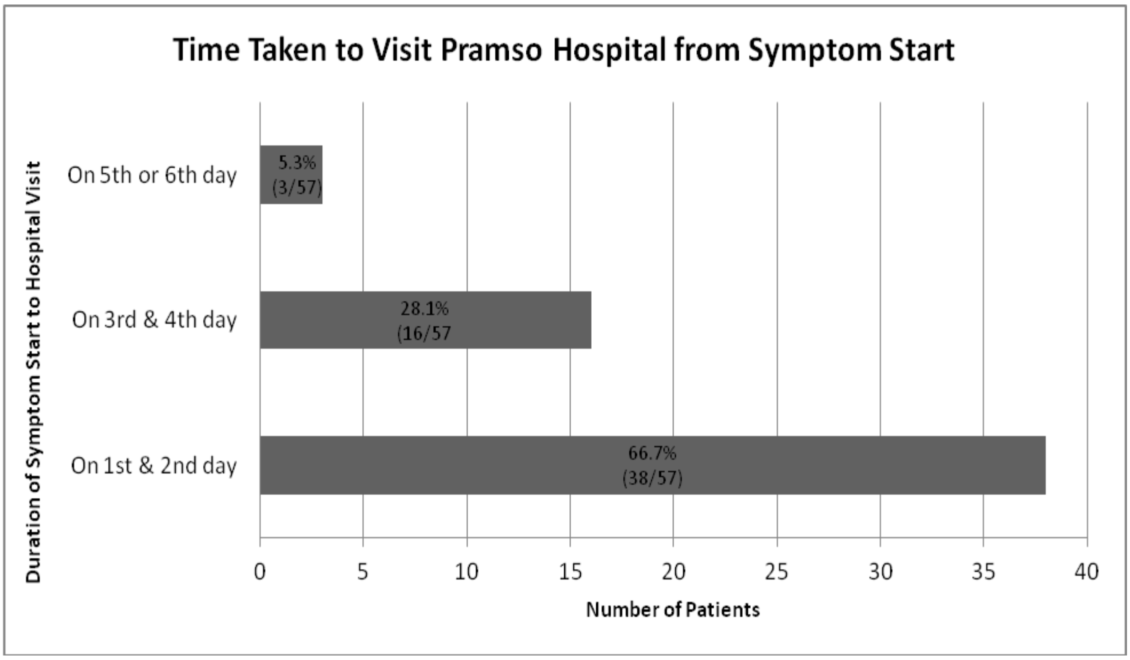


Figure 13: Pramso Hospital visit after observing a symptom

Table 2: Distance to Pramso Hospital

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	≤30 min.	17	24,6	30,4	30,4
	>30 mins. & <60 mins.	39	56,5	69,6	100,0
	Total	56	81,2	100,0	
Missing	System	13	18,8		
Total		69	100,0		

Out of the 64 patients who where included in the study at Pramso 57 showed symptoms of malaria on admission and 7 did not. Of those who showed Sympstoms of malaria on admission, 61.4% (35) and 38.6% (22) were males and females respectively. Of the 64 children, 28 manifested fever with malaria and 36 did not. Out of the 28 patients 64.3% (18) and 35.7% (10) were males and females respectively (see figure 14 below).

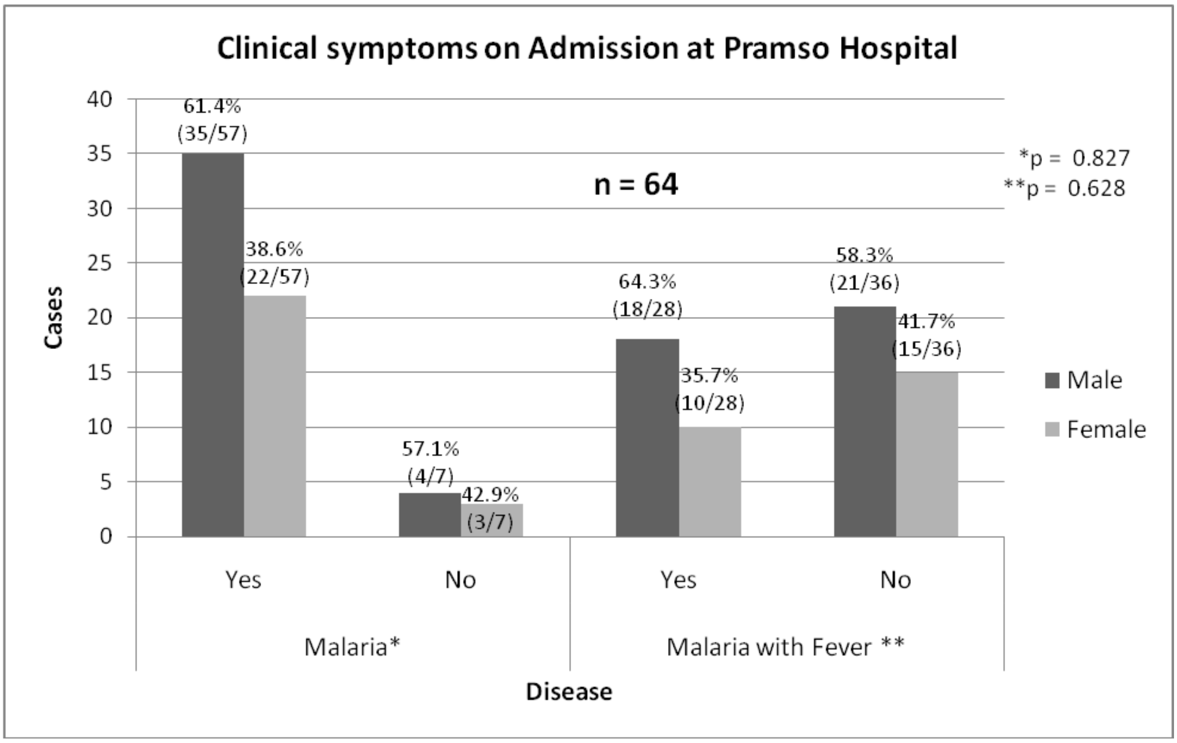


Figure 14: Clinical symptom on admission at Pramso Hospital by Gender- Malaria & Malaria with Fever

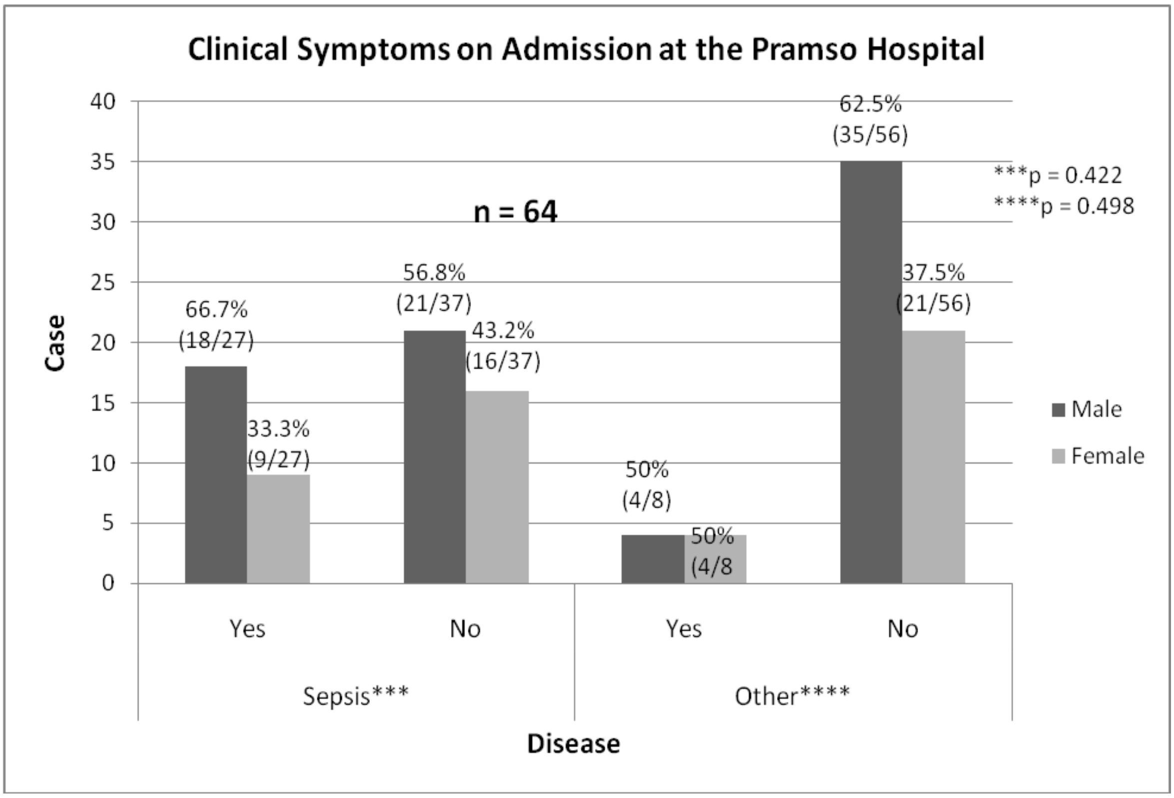


Figure 15: Clinical symptom on admission at Pramso Hospital by Gender - Sepsis & other

Sepsis was also recorded as clinical symptom on admission for 27 patients and 37 of the patients did not show any symptom. Out of the those who manifested the symptom 66.7% were males and 33.3% were females. However 8 patients showed other symptoms and 56 did not whereas both male and female represented 50% (4) each of the cases for those patients who showed other symptoms (see above).

Patients under 1 year of age showed the most symptoms of malaria on admission (40.4% [23/57]) than those older than 1 year and 2 years or younger (31.6% [18/57]) as well as those above 2 years and younger than 5 years of age (28.1% [16/57]). Under those who showed symptoms of fever with malaria those older than 1 year or younger and those older than 2 years or younger (both 34.5% [10/29]) showed relatively more symptoms than those under 1 years of age (31.0% [9/29]) (see figure 16).

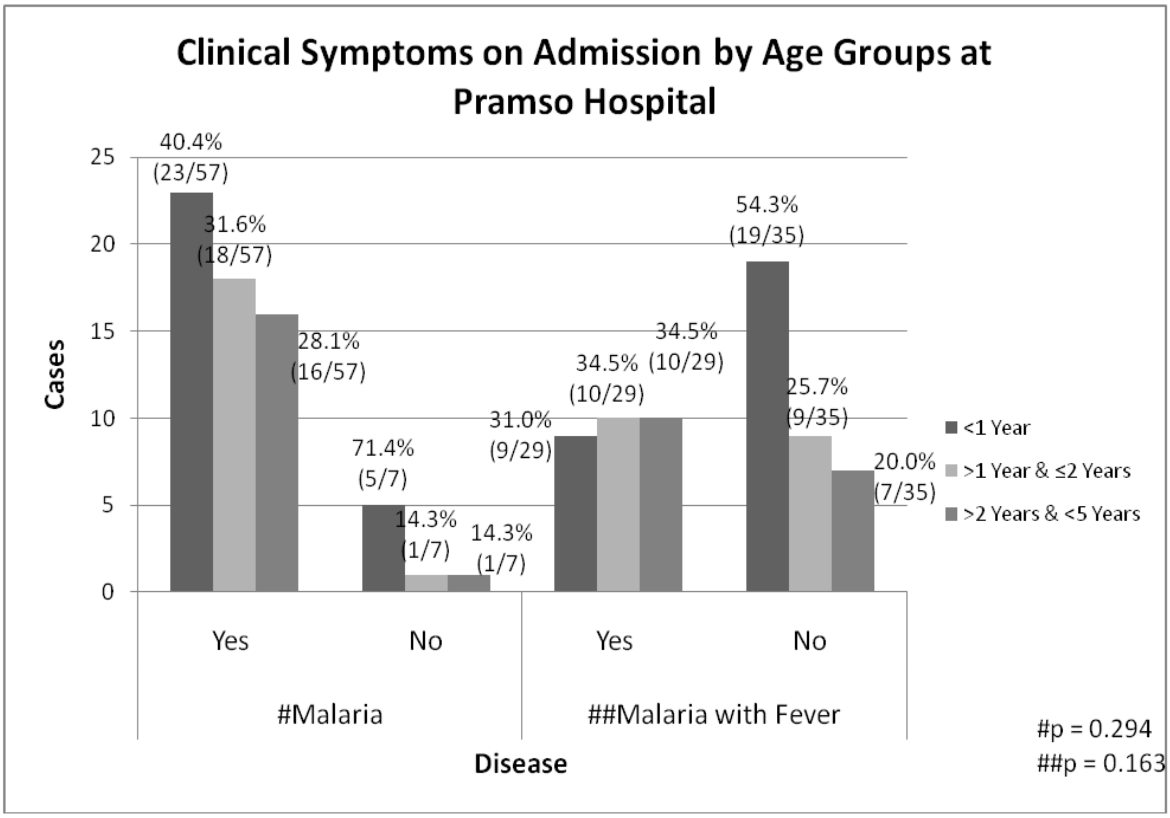


Figure 16: Clinical symptom on admission at Pramso Hospital by Age Groupings - Malaria & Malaria with Fever

Out of the total number of patients who reported at the Pramso Hospital, 29 showed symptoms of sepsis on admission but 35 did not have any sepsis out of which. Twelve out of the 29 patients who showed symptom of sepsis (41.1%) were under 1 year of age with those older than 2 years and younger than 5 years representing 31.0% (9/29). Only 9 out of 64 patients showed other clinical symptoms. Out of this nine patients those under 1 year were the majority representing 55.6% (5/9) (see figure 17 below).

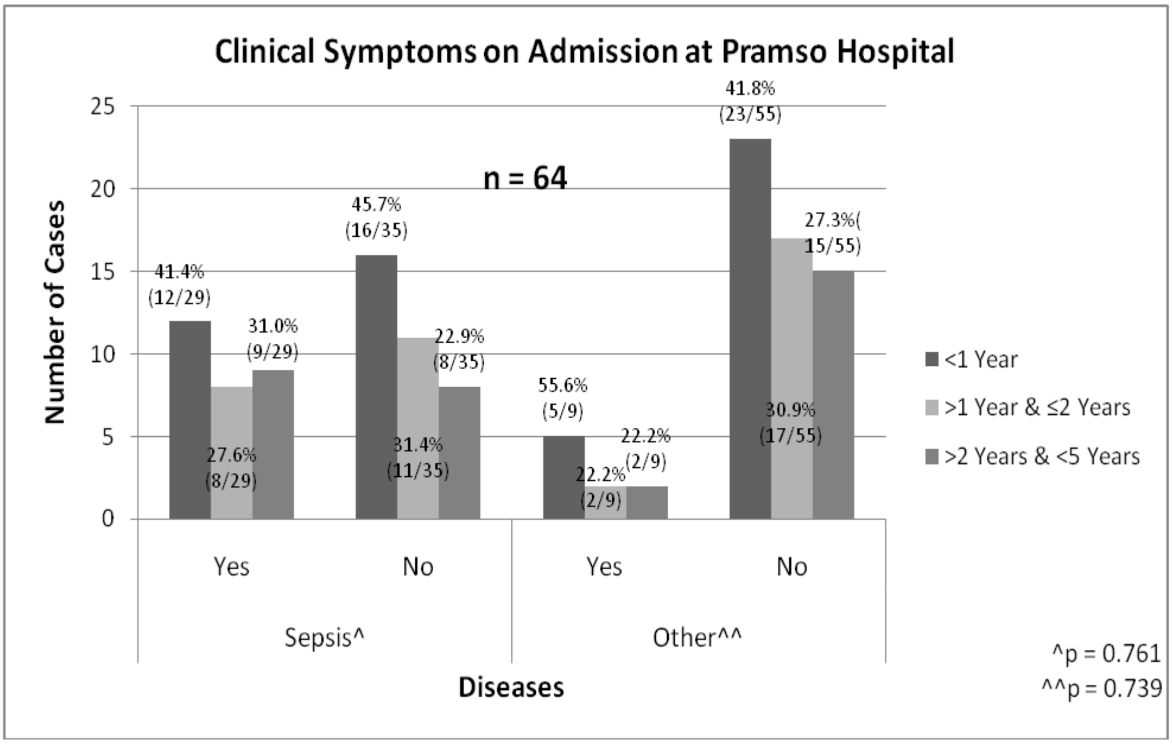


Figure 17: Figure 14: Clinical symptom on admission at Pramso Hospital by Age Groupings - Sepsis & other

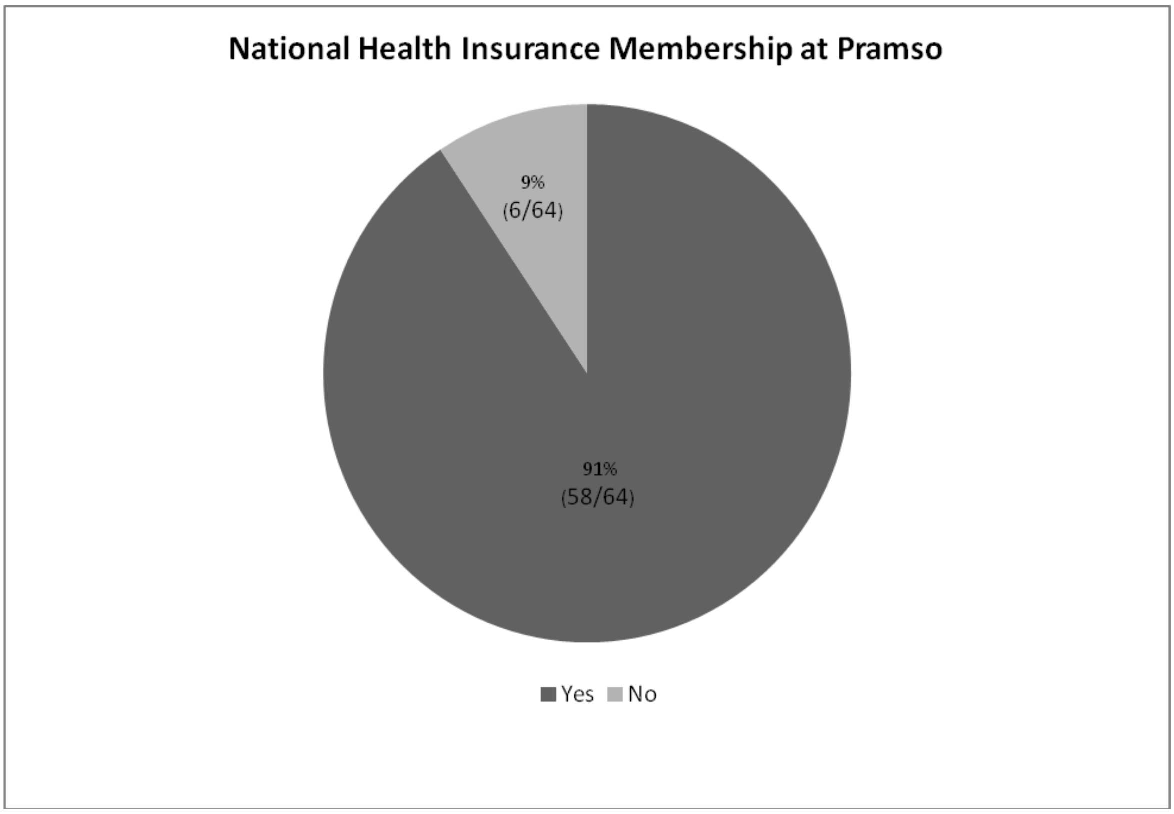


Figure 18: Health insurance membership for parents of patients at Pramso Hospital

Almost all the parents (90.6% [58/64]) who accompanied their wards to the Pramso Hospital were health insured with only 9.4% (6/64) uninsured.

Table 3: Educational level of parents accompanying children to Pramso Hospital

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary or no education	25	36,2	39,1	39,1
	Junior High School	33	47,8	51,6	90,6
	Senior High School or Tertiary	6	8,7	9,4	100,0
	Total	64	92,8	100,0	
Missing	System	5	7,2		
Total		69	100,0		

Table 21 shows that 39.1% (25/64) of the care-givers who accompanied their ward to the Pramso Hospital had primary or no education with 51.6% (33/64) having a Junior High School background and the rest 9.4% (6/64) had Senior High education or tertiary education.

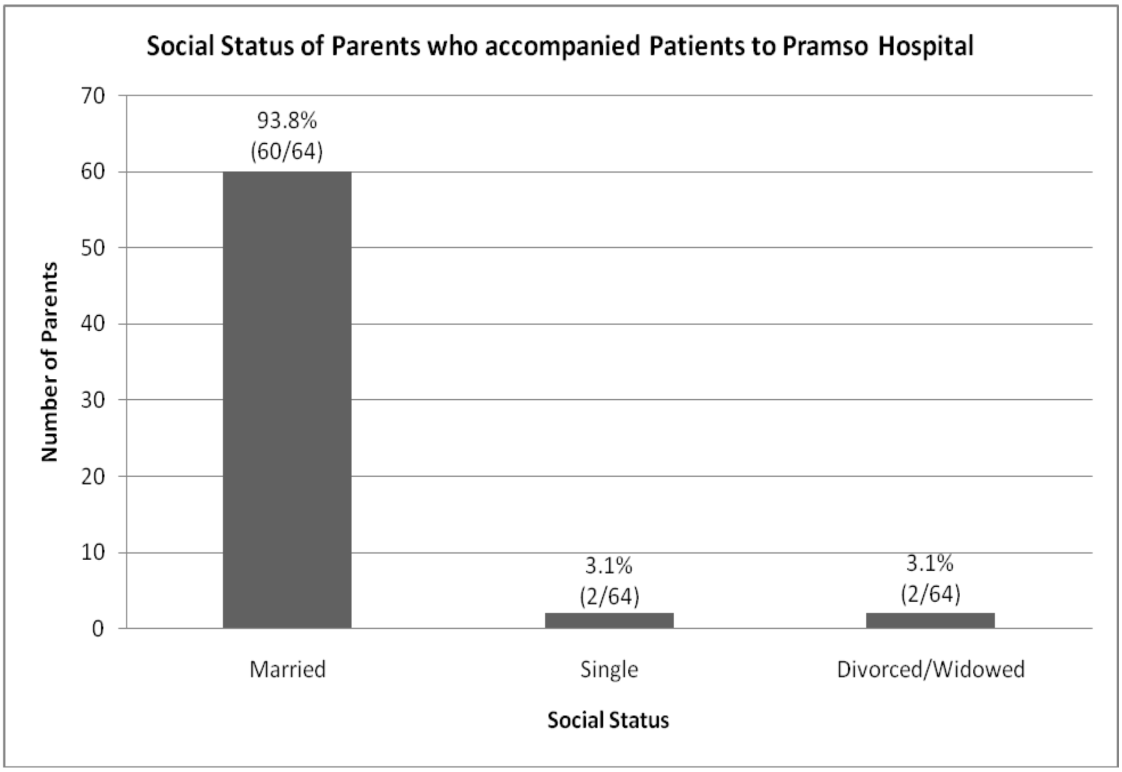


Figure 19: Social status of parents who accompanied their children to the Pramso Hospital

Out of the 64 care-givers who accompanied the children to the Pramso Hospital, 93.8% (60/64) were married with those being single and divorced or widowed each representing 3.1% (2/64).

Most of the mothers (45.5%) who accompanied their wards to the hospital have 1 to 2 children (25/55) with 29.1% (16/55) and 25.1% (14/55) having 2 to 4 and 5 or more children respectively as shown in table 4.

Table 4: Number of children to a parent accompanying a child to Pramso Hospital

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 to 2 children	25	36,2	45,5	45,5
	2 to 4 children	16	23,2	29,1	74,5
	5 or more children	14	20,3	25,5	100,0
	Total	55	79,7	100,0	
Missing	System	14	20,3		
Total		69	100,0		

Out of the 65 parents who answered the question on occupation, 93.8% (61/65) were employed whereas only 6.2% (4/65) were unemployed (see table 5).

Table 5: Occupation of parents accompanying a child to Pramso Hospital

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employed	61	88,4	93,8	93,8
	Unemployed	4	5,8	6,2	100,0
	Total	65	94,2	100,0	
Missing	System	4	5,8		
Total		69	100,0		

7.1.2 Inferencial Statistics

Table 6: Cross tabulation of age groupings and malaria slide analysis

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age groupings of patients * Malaria slide analysis result	63	91,3%	6	8,7%	69	100,0%

Age groupings of patients * Malaria slide analysis result Crosstabulation

			Malaria slide analysis result		
			Positive	Negative	Total
Age groupings of patients	Under 1 year	Count	15	12	27
		% within Malaria slide analysis result	37,5%	52,2%	42,9%
	Older than 1 year but less than or equal to 2 years	Count	11	8	19
		% within Malaria slide analysis result	27,5%	34,8%	30,2%
	Older than 2 years but less than 5 years	Count	14	3	17
		% within Malaria slide analysis result	35,0%	13,0%	27,0%
Total		Count	40	23	63
		% within Malaria slide analysis result	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3,599[a]	2	,165
Likelihood Ratio	3,888	2	,143
Linear-by-Linear Association	2,864	1	,091
N of Valid Cases	63		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 6,21.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	,239	,165
	Cramer's V	,239	,165
N of Valid Cases		63	

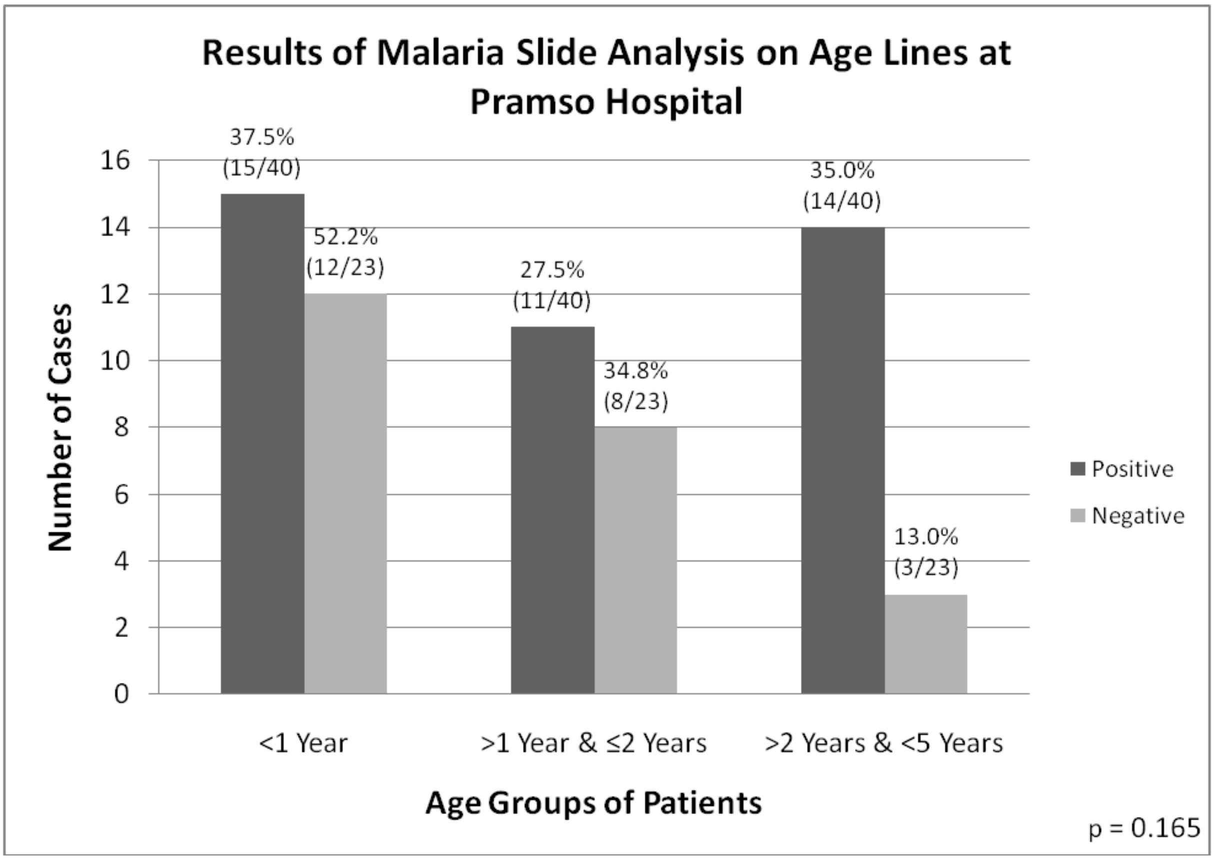


Figure 20: Malaria slide analysis and age

Table 6 above shows that of the 40 patients who tested positive after the malaria analysis from 63 malaria slides, 37.5% (17/40) tested positive followed by those older than 2 years and younger than 5 years with 35% (14/40). However among patients older than 1 year and 2 years or younger 27.5% (11/40) tested positive.

Table 7: Cross tabulation of gender and malaria slide analysis

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender of patient * Malaria slide analysis result	63	91,3%	6	8,7%	69	100,0%

Gender of patient * Malaria slide analysis result Crosstabulation

			Malaria slide analysis result		
			Positive	Negative	Total
Gender of patient	Male	Count	26	12	38
		% within Malaria slide analysis result	63,4%	54,5%	60,3%
	Female	Count	15	10	25
		% within Malaria slide analysis result	36,6%	45,5%	39,7%
Total		Count	41	22	63
		% within Malaria slide analysis result	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,471[a]	1	,493		
Continuity Correction[b]	,173	1	,678		
Likelihood Ratio	,468	1	,494		
Fisher's Exact Test				,592	,337
Linear-by-Linear Association	,463	1	,496		
N of Valid Cases	63				

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 8,73.

b. Computed only for a 2x2 table

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	,086	,493
	Cramer's V	,086	,493
N of Valid Cases		63	

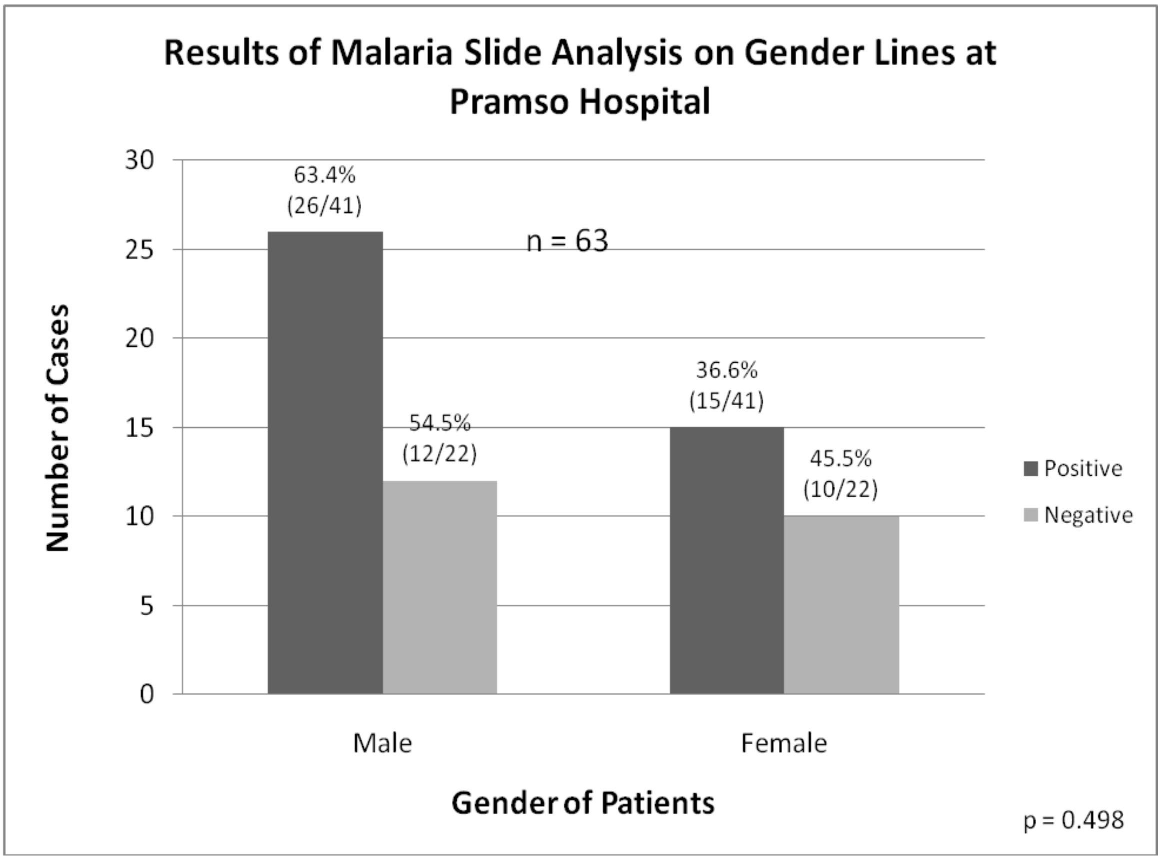


Figure 21: Malaria slide analysis and gender

From the above table one could see that among those patients who tested positive from the malaria slide analysis of 63 patients, males made up 63.4% (26/41) and females being 36.6% (15/41).

Table 8: Cross tabulation of time spent in hospital and recovery status on discharge

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Time spent in hospital (days) * Recovery status on discharge	62	89,9%	7	10,1%	69	100,0%

Time spent in hospital (days) * Recovery status on discharge Crosstabulation

			Recovery status on discharge				Total
			Very good	Good	O.k.	Bad	
Time spent in hospital (days)	1 - 3 days	Count	1_a	23_a	4_a	0_a	28
		% within Recovery status on discharge	100,0%	46,9%	36,4%	,0%	45,2%
	4 - 6 days	Count	0_a	18_a	7_a	1_a	26
		% within Recovery status on discharge	,0%	36,7%	63,6%	100,0%	41,9%
	7 days or more	Count	0_a	8_a	0_a	0_a	8
		% within Recovery status on discharge	,0%	16,3%	,0%	,0%	12,9%
Total		Count	1	49	11	1	62
		% within Recovery status on discharge	100,0%	100,0%	100,0%	100,0%	100,0%

Each subscript letter denotes a subset of Recovery status on discharge categories whose column proportions do not differ significantly from each other at the ,05 level.

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6,237[a]	6	,397
Likelihood Ratio	8,207	6	,223
Linear-by-Linear Association	,114	1	,735
N of Valid Cases	62		

a. 9 cells (75,0%) have expected count less than 5. The minimum expected count is ,13.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	,317	,397
	Cramer's V	,224	,397
N of Valid Cases		62	

Though length of stay in the admission wards have no significant impact on the outcome of treatment, as shown by the analysis of the information provided by the pediatrician of the Pramso Hospital, out of the 49 patients rated by the pediatrician as having a "good" recovery status on discharge 46.9% (23/49) stayed for 1 to 3 days in the admission wards of the hospital followed by those who stayed for 4 to 6 days with 36.7% (18/49).

7.1.3 Economic Analysis for Pramso

From the diagram below one could depict that care-givers' willingness to pay for the laboratory investigation and medical cost lies below GH¢ 20.00 New Ghana Cedis(US$ 11.71) with the amount paid for these services plus other indirect medical care cost like transport cost in real sense galloping far above GH¢ 20.00 New Ghana Cedis.

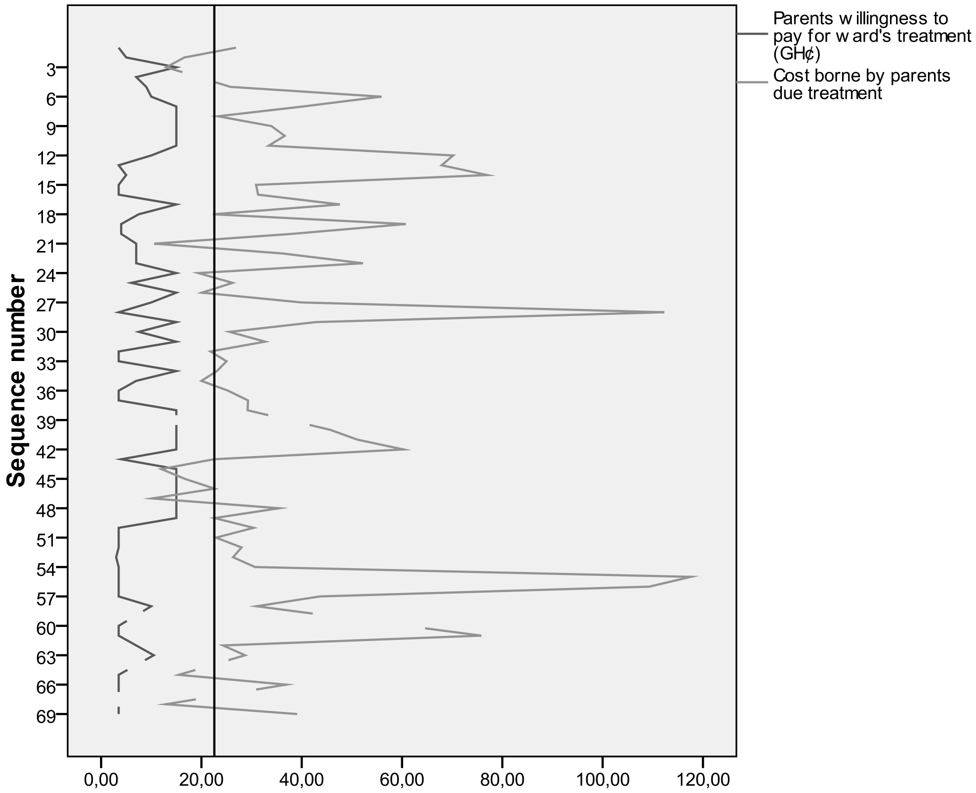


Figure 22: Caseplot showing Willingness-To-Pay and total cost of treatment at Pramso Hospital

However the cost of laboratory investigation alone nears care-givers' willingness to pay for the laboratory services as well as the medical cost but in real sense also a difficult issue to match since the average weekly household income is GH¢ 4.00 New Ghana Cedis (US$ 2.34) which makes GH¢ 16.00 New Ghana Cedis (US$ 9.37) per month. Moreover comparing all the sub-cost aspects of the care-giver vis-a-vis the total treatment cost incurred by the care-giver (parents and or guardians) brings a very big cost gap that without any intervention laboratory investigation and drug's cost will be unaffordable for the care-giver (see figures 23 and 24).

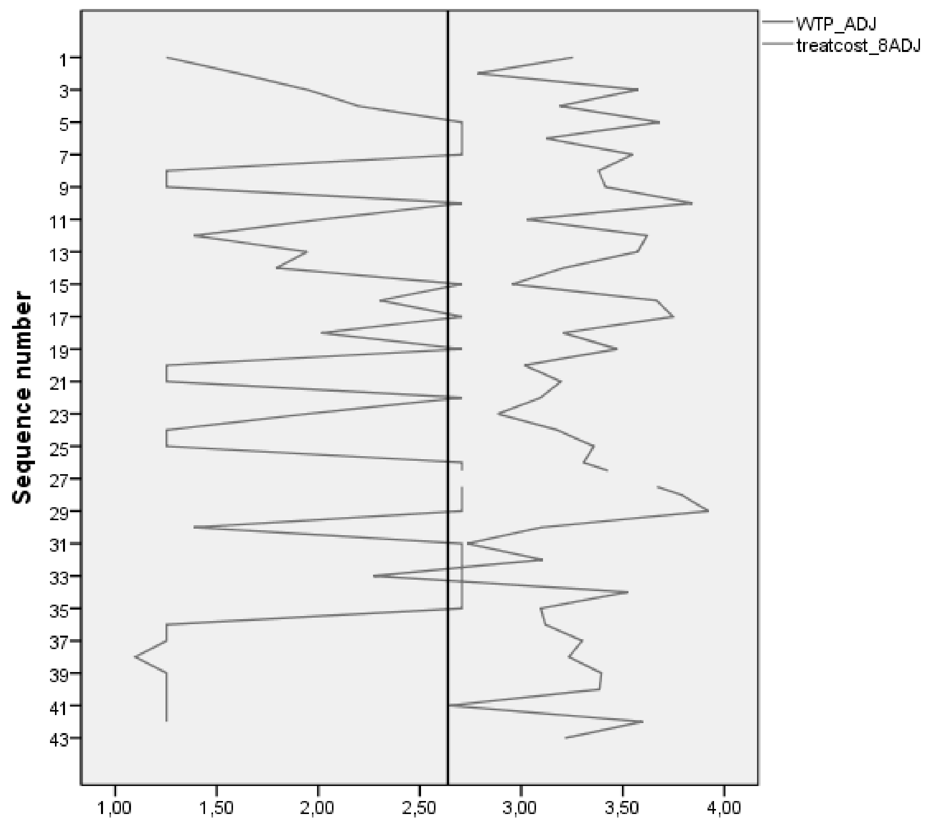


Figure 23: Caseplot showing Willingness-To-Pay and cost of treatment drugs and laboratory analysis

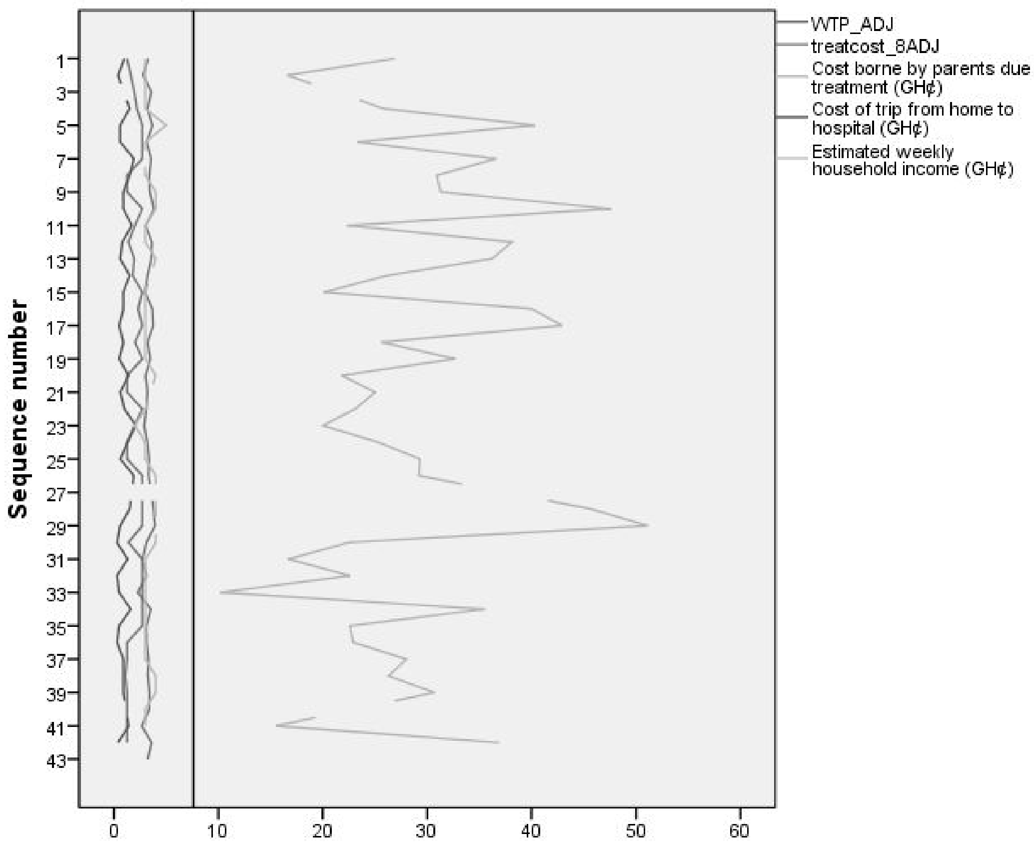


Figure 24: Caseplot comparing all cost and income

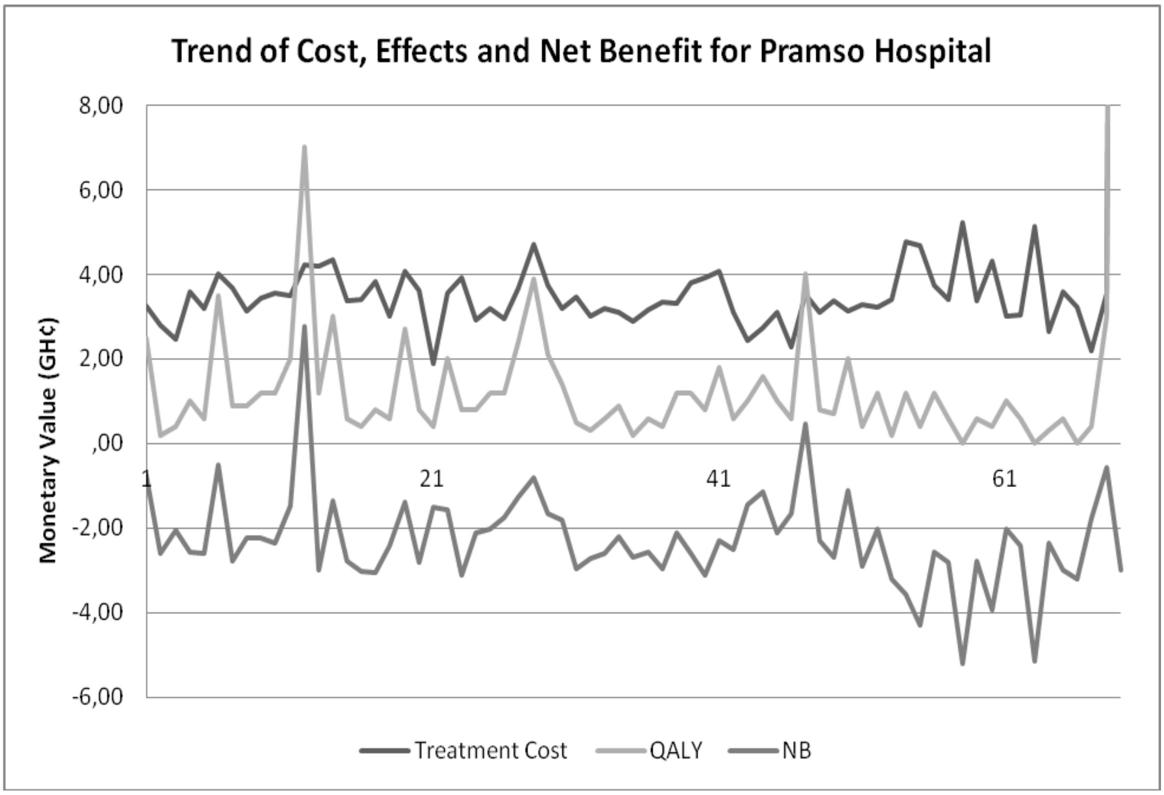


Figure 25: A graph displaying Net Benefit of the standard diagnostic system at Pramso Hospital

From the analysis done total cost was **is** GH¢ 234.40 New Ghana Cedis (US$ 137.24) and total benefit was is GH¢ 80.60 New Ghana Cedis (US$ 47.19). Putting these figures in equation 2 we arrive at the following:

Net Benefit = GH¢ 80.60 - GH¢ 234.40

Net benefit is therefore: minus GH¢ 153.80 (minus US$ 90.05)

Since the net benefit for the diagnostic system at Pramso Hospital is negative the standard diagnostic system has no value for money.

The diagram below tells us that the far distance a care-giver had to travel with a patient the higher cost of transportation they have to bare. About 56% of the proportion of variance in the cost of transportation to the Pramso Hospital can be is explained by the distance to the hospital as shown in figure 33.

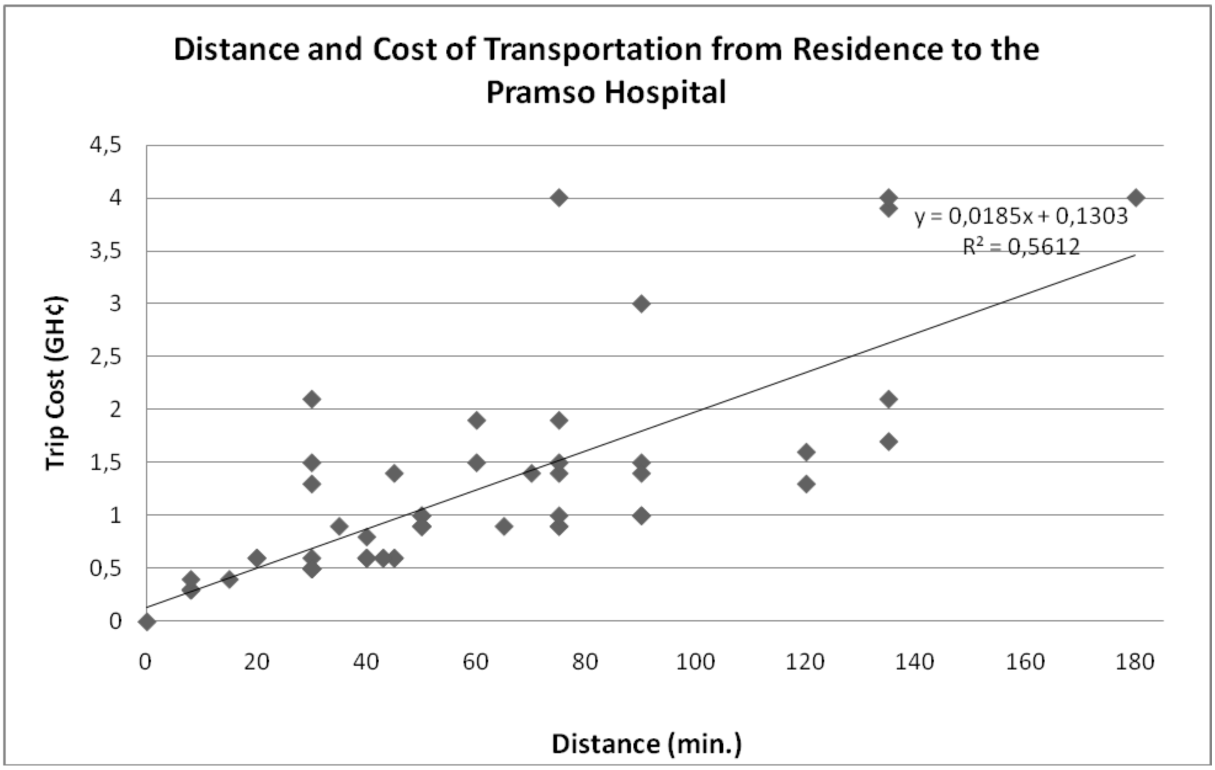


Figure 26: Scatter plot displaying the relationship between distance to Pramso Hospital and cost of transportation

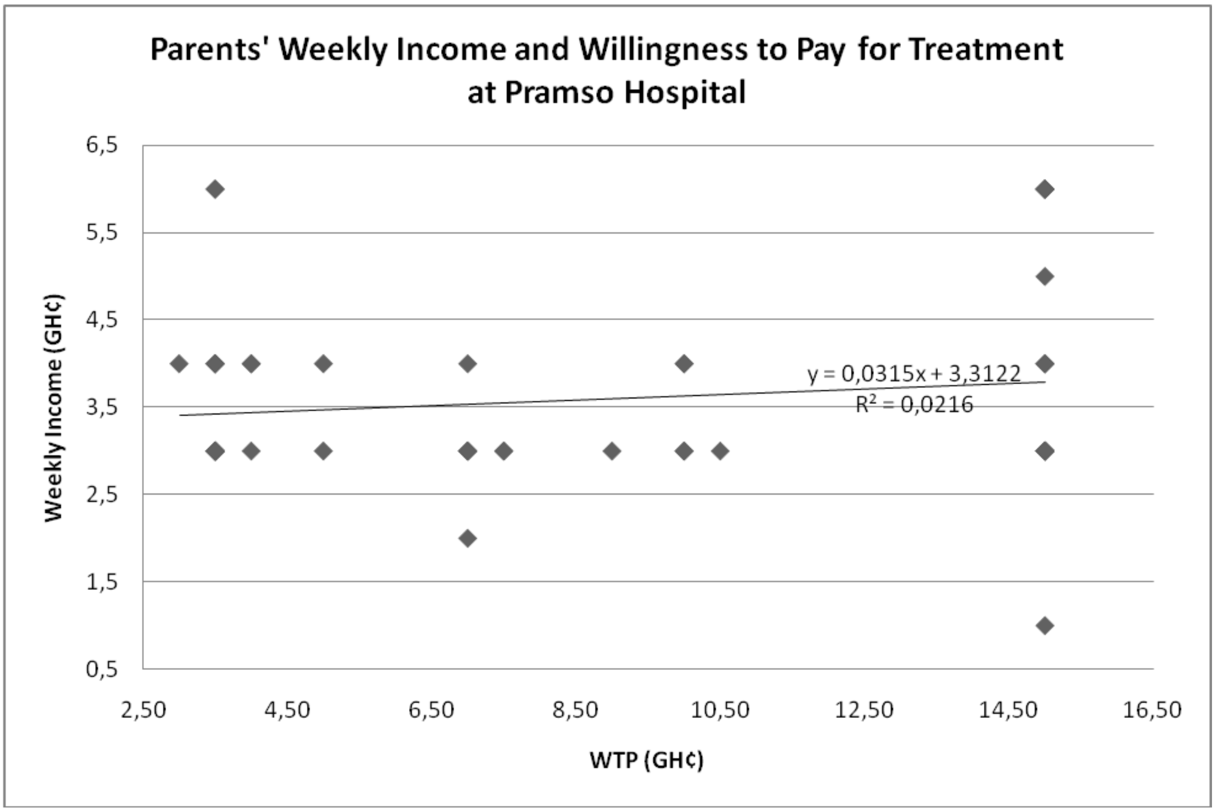


Figure 27: Scatter plot showing relationship between weekly income and willingness to pay for treatment

But in the case of weekly income of the household of care-givers in relation to their willingness to pay for laboratory investigation and drug cost of their wards, only 2% of the proportion of the variance in weekly household income could be explained by their willingness to pay for the same service (laboratory service and drugs cost) (see figure 27).

The diagrams below endorses the fact that an intervention is needed to enable care-givers (thus parents and/or guardians) to be able to access the health care necessary for treating their children. This is because one could tell from figure 35 that though care-givers' willingness to pay for laboratory

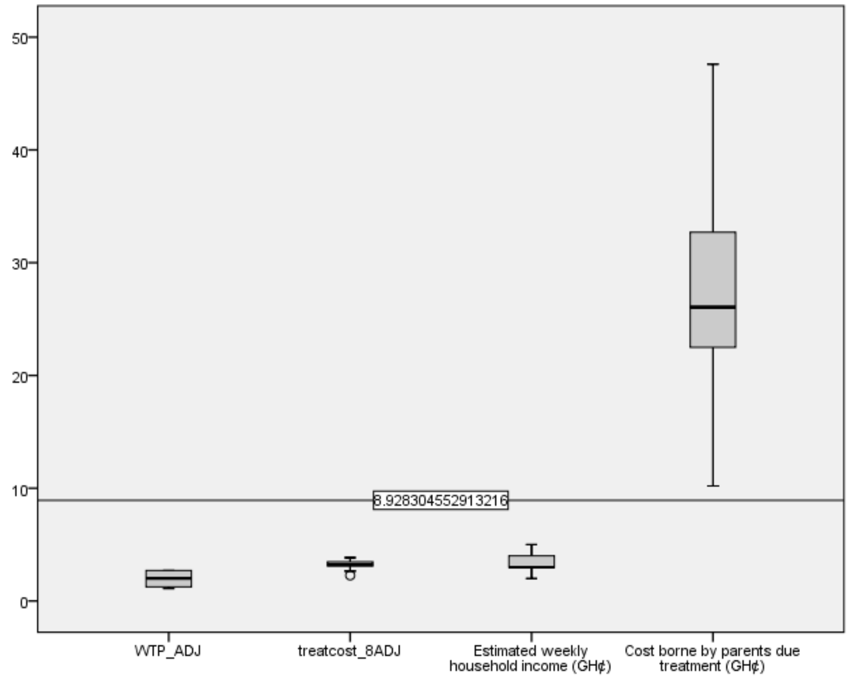


Figure 28: Comparison of the Income and Cost of Parents at Pramso Hospital after adjusting for outliers

investigation and drug costs of their wards is a bit closer to the real cost of services or treatment offered in real sense but the total cost that arises due to the treatment of the patients far outweighs care-givers imagination. In the diagram above one could see that the total cost of treatment (including transportation cost) is about the average cost of GH¢ 9 New Ghana Cedis (US$ 5.27).

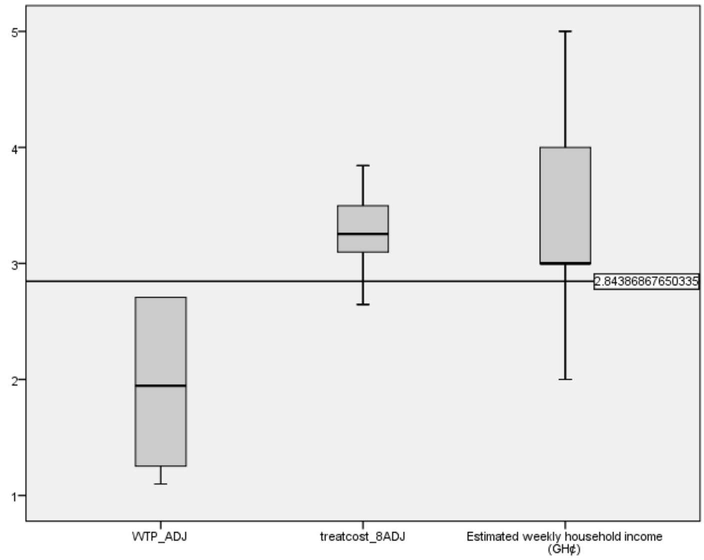


Figure 29: Comparison of the WTP and Cost of treatment at Pramso Hospital

However, taking out the total cost of due to treatment, one could see some slight relation of care-givers' willingness to pay for laboratory investigation and drug costs but yet still the willingness to pay lies below the average of laboratory investigation costs and drug costs of GH¢ 3 New Ghana Cedis (see figure 29).

Table 9: Length of stay and cost of treatment at Pramso Hospital

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Time spent in hospital (days) * Cost incurred by parents on treatment (GH¢)	68	98,6%	1	1,4%	69	100,0%

Time spent in hospital (days) * Cost incurred by parents on treatment (GH¢) Crosstabulation

			Cost incurred by parents on treatment (GH¢)			Total
			1 - 2 GH¢	3 - 4 GH¢	≥5 GH¢	
Time spent in hospital (days)	1 - 3 days	Count	8_a	21_a	1_b	30
		% within Cost incurred by parents on treatment (GH¢)	72,7%	46,7%	8,3%	44,1%
	4 - 6 days	Count	3_a	19_a	6_a	28
		% within Cost incurred by parents on treatment (GH¢)	27,3%	42,2%	50,0%	41,2%
	7 days or more	Count	0_a	5_a	5_b	10
		% within Cost incurred by parents on treatment (GH¢)	,0%	11,1%	41,7%	14,7%
Total		Count	11	45	12	68
		% within Cost incurred by parents on treatment (GH¢)	100,0%	100,0%	100,0%	100,0%

Each subscript letter denotes a subset of Cost incurred by parents on treatment (GH¢) categories whose column proportions do not differ significantly from each other at the ,05 level.

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14,290[a]	4	,006
Likelihood Ratio	15,446	4	,004
Linear-by-Linear Association	12,913	1	,000
N of Valid Cases	68		

a. 5 cells (55,6%) have expected count less than 5. The minimum expected count is 1,62.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	,458	,006
	Cramer's V	,324	,006
N of Valid Cases		68	

A significant relation is seen between the cost of treatment (thus for laboratory investigation and drugs) and the length of stay in the pediatric wards of the Pramso Hospital during admission as shown in table 37 above. Care-givers who accompanied the patients to the Pramso Hospital mostly (45 out of 68 care-givers) had to pay GH¢ 3 to GH¢ 4 New Ghana Cedis (US$ 1.76 to US$ 2.34) for the treatment of their wards during admission in the pediatric ward. Out of this number of care-givers, about 46.7% (21/45) had their children staying in the pediatric ward for one to three days during admission followed by those who had their children stay for four to six days (42.2% [19/45]) and those who stayed for a week or more made up the 11.1% (5/45) of those who paid the above mentioned cost of treatment.

Moreover the rest of care-givers had to pay GH¢ 5 New Ghana Cedis or more for the treatment of their wards. Among this groups of care-givers, most had their children stay for four to six days in admission (50% [6/12]) followed by those who had their children stay for a week or more (41.7% [5/12]).

7.1.4 Satisfaction Survey

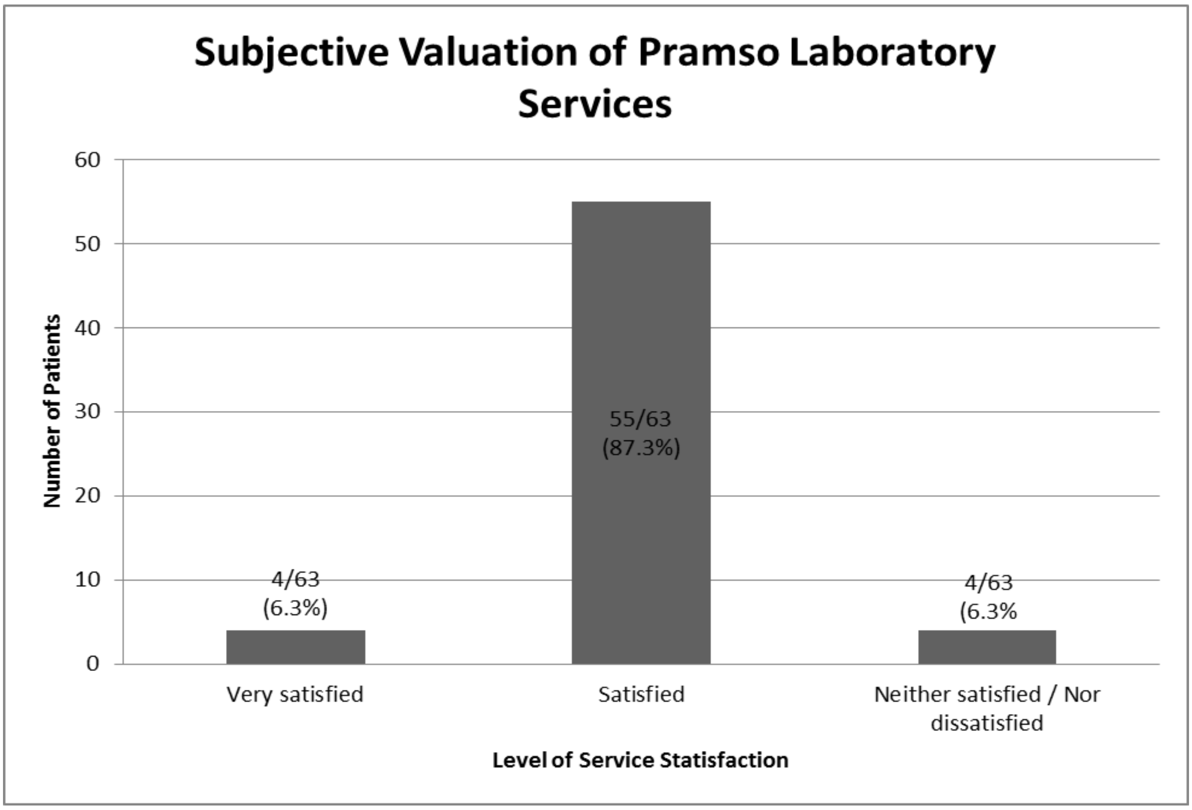


Figure 30: Satisfaction survey on the services of Pramso Hospital laboratory

The satisfaction survey of the care-givers who accompanied their wards to the Pramso Hospital shows that most care-givers were satisfied with almost all the services offered by the hospital. Out of the 63 care-givers interviewed 87.3% (55/63) said they were "satisfied" with the laboratory services offered by the Pramso Hospital, 88.9% (56/63) were also "satisfied" with the services offered by the hospital's personnel and 55.6% (35/63) said to be "satisfied" with the treatment offered by the Pramso Hospital. However, it is worth noticing that 38.1% (24/63) of the care-givers interviewed said they were "very satisfied" with the treatment offered by the hospital (see figures 30, 31 and 32).

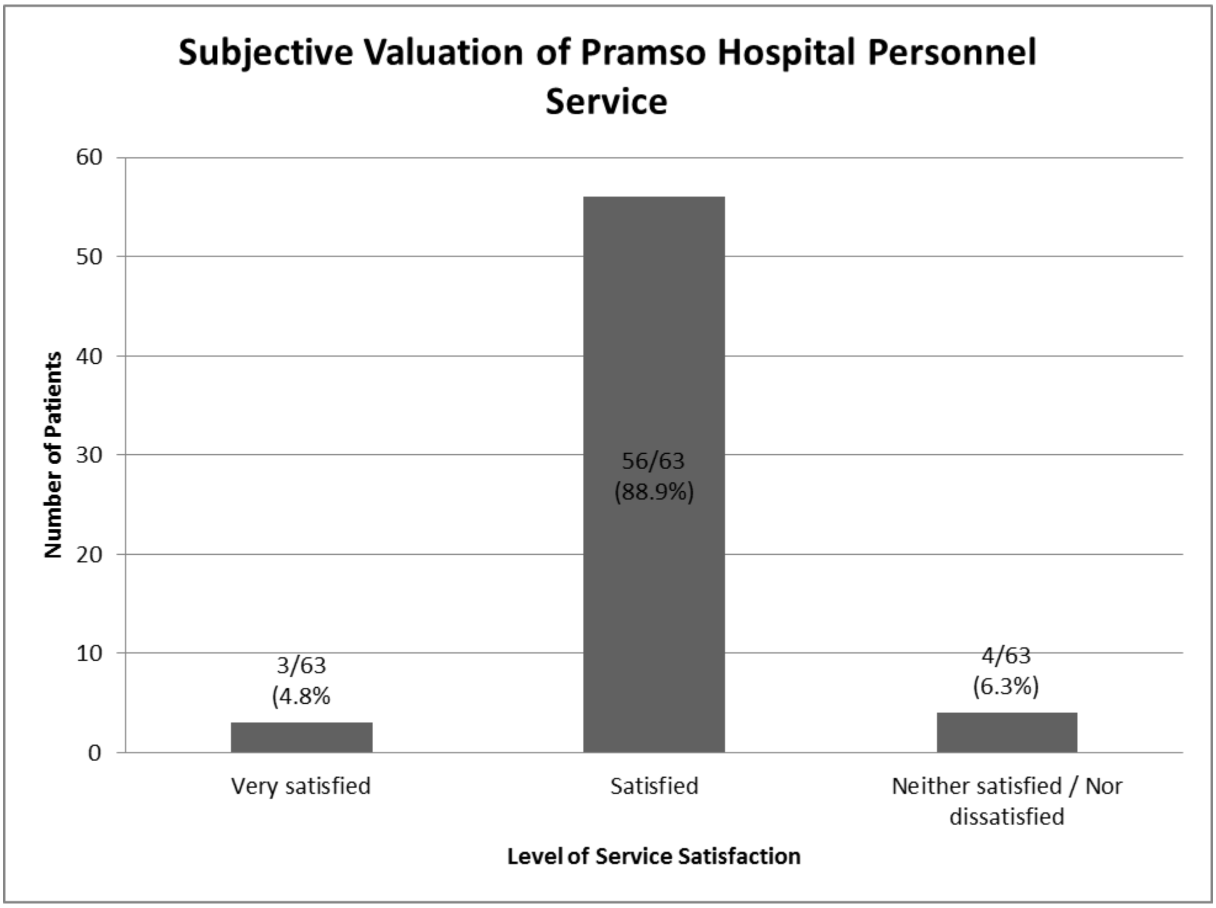


Figure 31: Satisfaction survey on the services of Pramso Hospital personnel

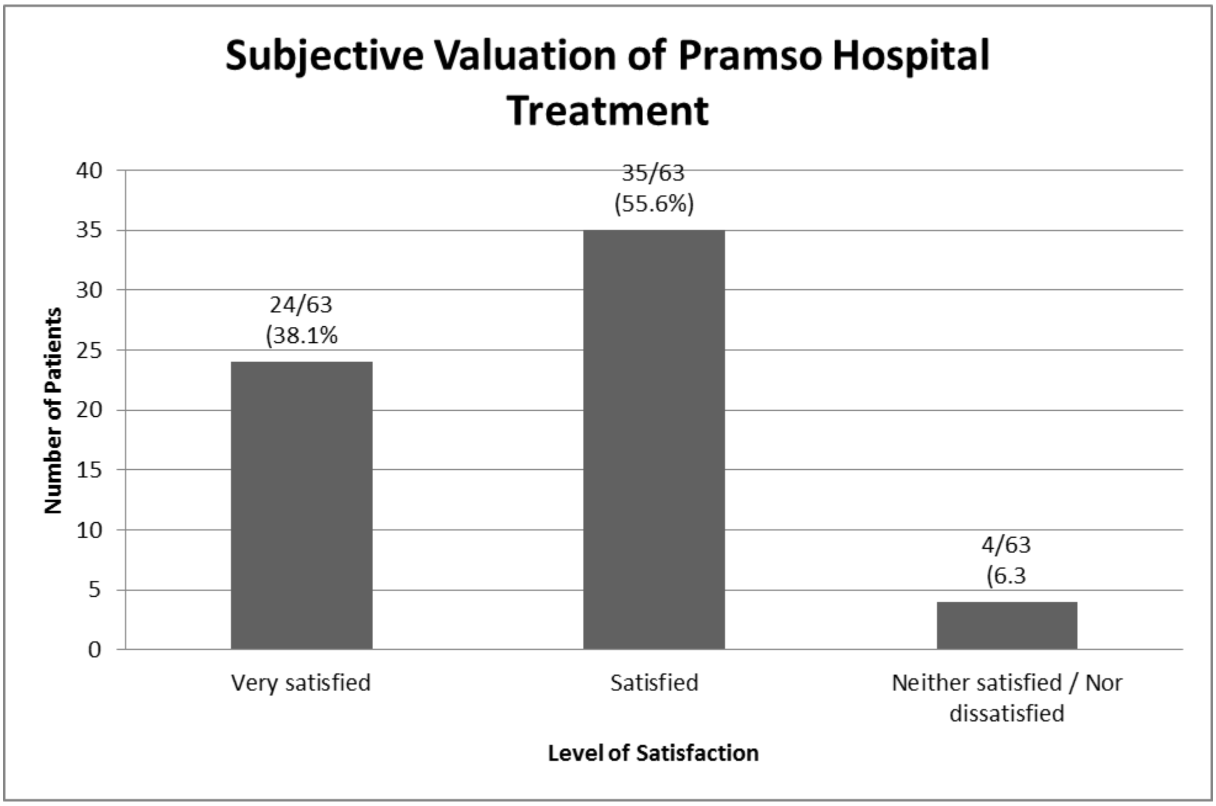


Figure 32: Satisfaction survey on the services of Pramso Hospital treatment

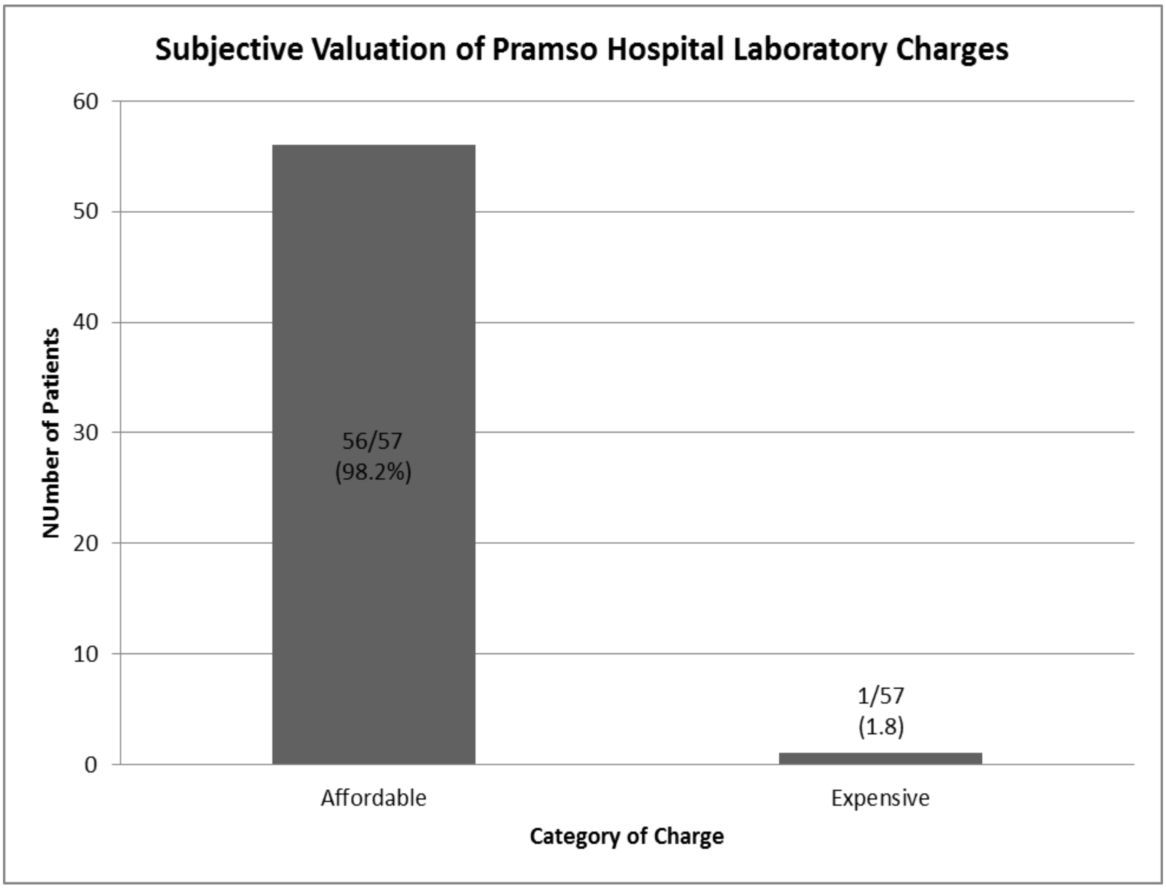


Figure 33: Valuation of Pramso Hospital laboratory charges

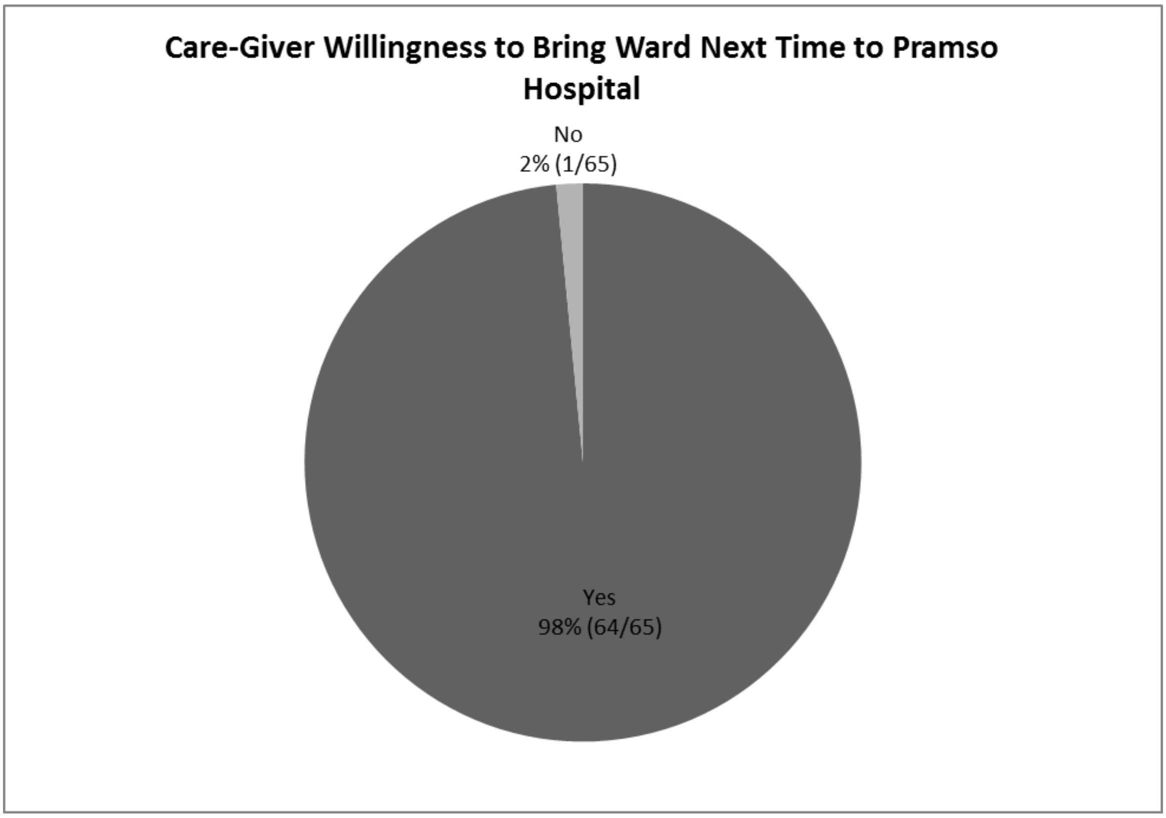


Figure 34: Caregiver's willingness to bring child to the Pramso Hospital again

Fifty-seven of the care-givers responded to the question on the hospital's laboratory charges of whom 98.2% (56/57) said the charges are "affordable" whereas only 1.8% said it is "expensive" as shown in figure 41.

Furthermore of the 65 care-givers who answered the question of the "willingness to bring their ward to the Pramso Hospital next time the child is ill", 98% (64/65) answered with "YES" and only 2% (1/65) answered with "NO".

7.2 Analysis for Agogo Hospital

7.2.1 Descriptive Statistics

Most care-givers take their children to the Agogo Hospital within the first 3 days after symptom manifestation. The average age of the patients included in the study at Agogo Hospital was 2 years of age and they stay on average for 3 days in the admission ward. Parents or care-givers pay on average GH¢ 34.00 New Ghana Cedis (US$ 22.3) for treatment drugs, cost laboratory investigation and transportation to the hospital. However the cost of treatment was on average GH¢ 24.10 New Ghana Cedis (US$ 14.11). On average care-givers or parents take thirty-three minutes to transport their children to the Agogo Hospital paying lorry fare of GH¢ 1.10 (US$ 0.64) on average.

Table 10: Statistics of vital indicators for Agogo Hospital

	N	Minimum	Maximum	Mean	Std. Deviation
Age of patient (Years)	54	,00	9,00	1,6366	2,16087
Day(s) symptom began	53	1	7	2,77	1,857
Duration of hospital stay	53	0	16	3,19	2,801
Distance from home to the hospital (min.)	54	5	180	33,33	31,051
Cost of trip from home to hospital (GH¢)	54	,30	6,00	1,0889	,97529
Parents willingness to pay for ward's treatment (GH¢)	48	2,00	15,00	5,1250	2,78770
Cost of samples taken in admission (GH¢)	54	0,00	20,00	8,5370	4,94388
Cost of tretament drugs in admission (GH¢)	54	1,80	70,70	24,0589	16,96452
Cost borne by parents due treatment (GH¢)	54	7,30	76,70	33,6848	17,95936
Estimated weekly household income (GH¢)	54	2	5	2,41	,714
Assessment of health condition	53	1	4	2,34	,678
Valid N (listwise)	46				

Parents who accompanied their children to the Agogo were willing to pay on average GH¢ 5.00 New Ghana Cedis (US$ 2.93) for the laboratory analysis of their children's samples although they earn an average of GH¢ 2.00 New Ghana Cedis (US$ 1.17) per week making GH¢ 8.00 New Ghana Cedis (US$ 4.68) per month.

Both gender (male and female) were fairly represented in the study at Agogo Hospital with males amounting to 52% (27/52) and females 48% (25/52) of the study population.

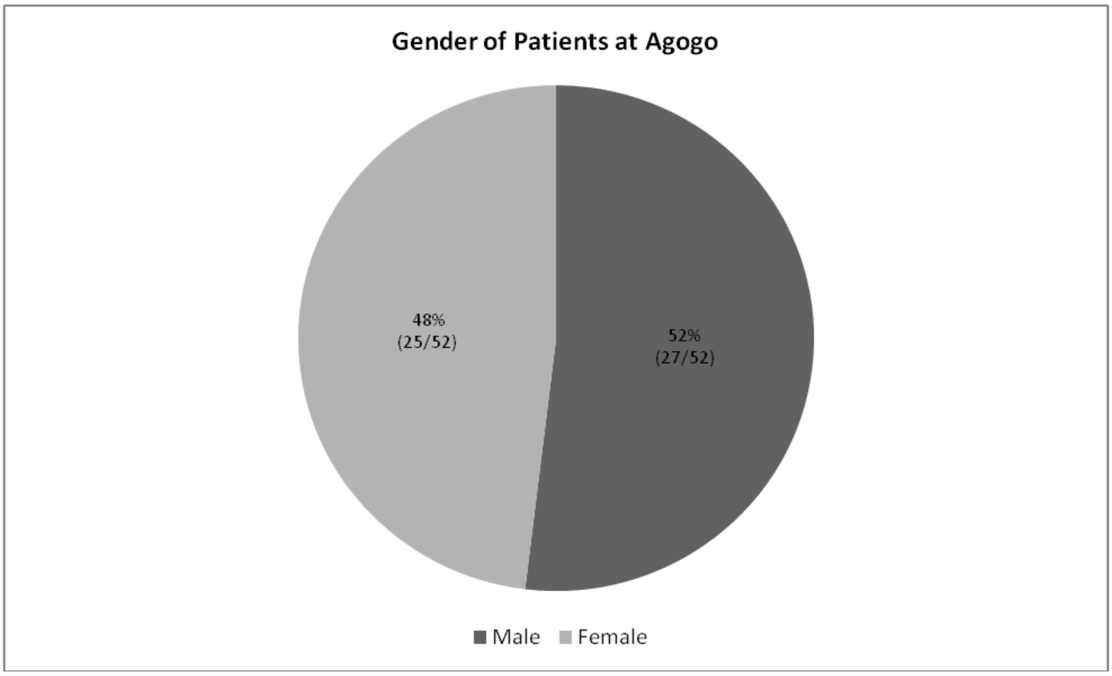


Figure 35: Gender of patients at Agogo Hospital

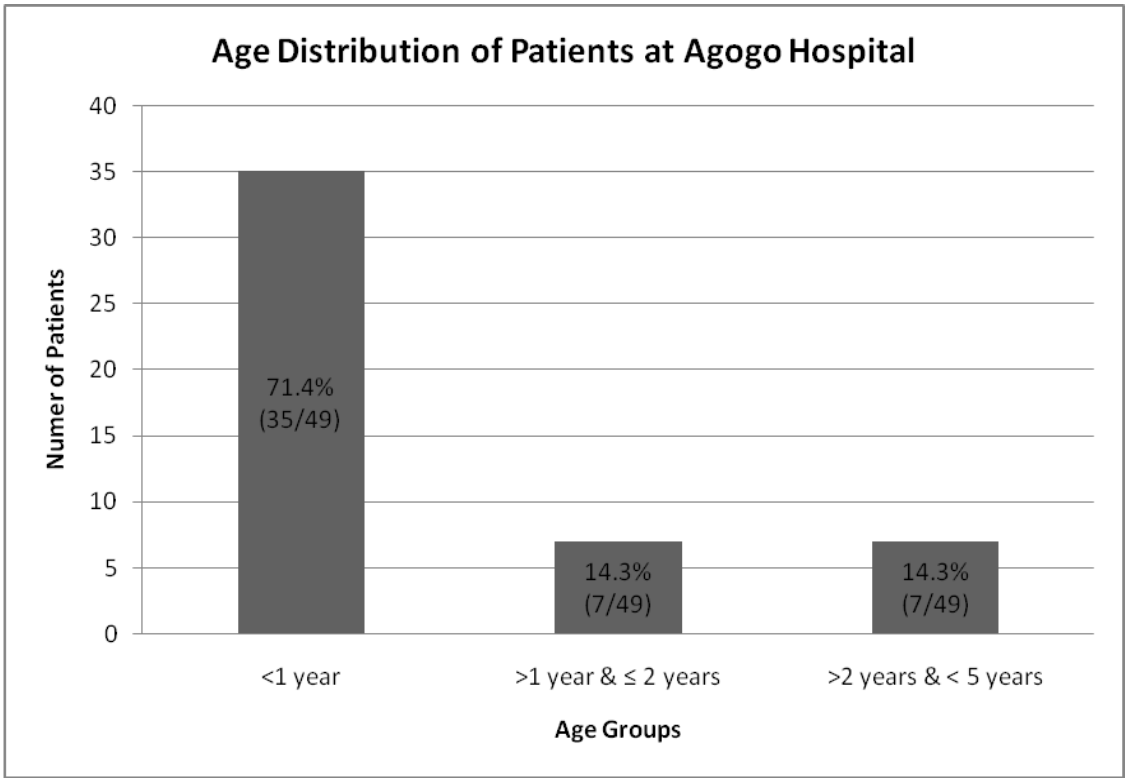


Figure 36: Age distribution of patients at Agogo Hospital

Most of the children in the study (35/49) were under 1 year of age representing 71.4% of the entire study population. Those older than 1 year and 2 years or younger as well as those older than 2 years and 5 years or younger were represented with the same proportion 14.3% (7/49) each (see figure 36).

Care-givers react quickly in taking their wards to the Agogo Hospital as most of them 54.2% (26/48) take their wards to the hospital within the first or second day upon noticing any change in the child and 39.6% (19/48) of the care-givers take their children to the hospital after the third or fourth day of symptom manifestation. Though not high but worth mentioning, about 6.3% (3/48) take their wards to the hospital afte the fifth or sixth day of realising a change in the child.

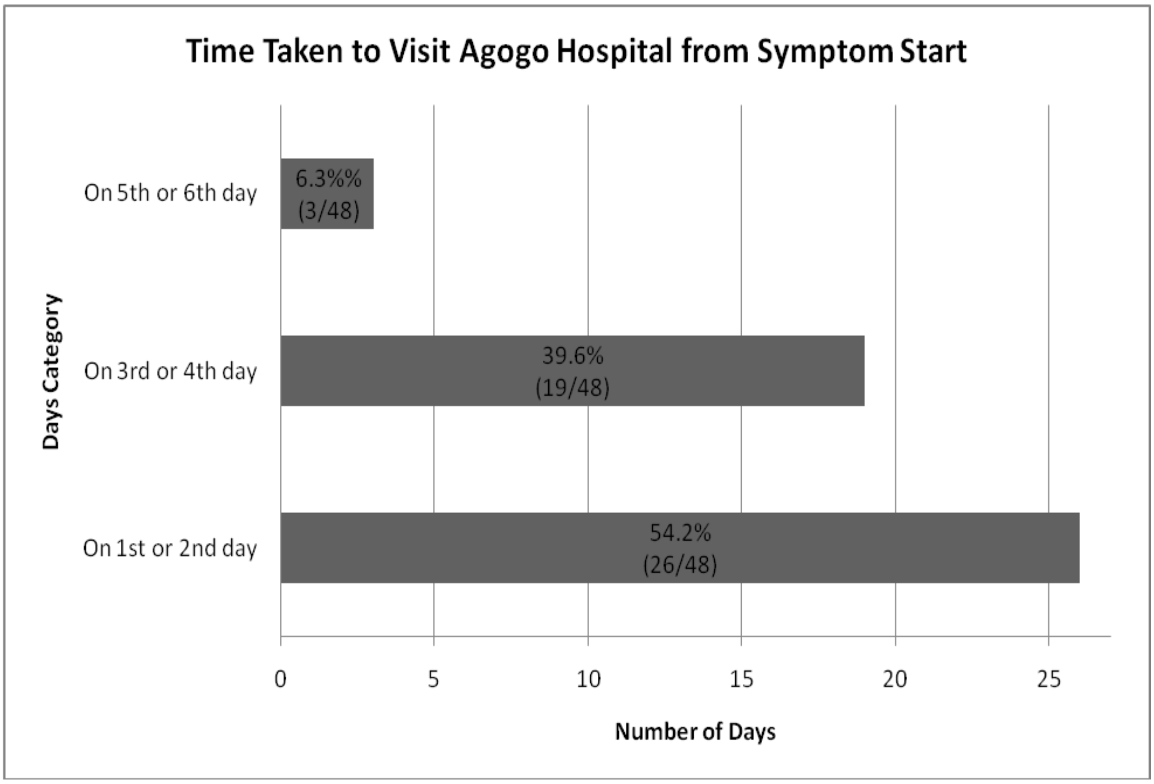


Figure 37: Agogo Hospital visit after observing a symptom

Table 11 shows that, most care-givers (53.7% [29/54]) have to travel 30 minutes or less in bringing their wards to the Agogo Hospital to seek treatment. Others (42.6% [23/54]) have to travel for more than 30 minutes and less than an hour to the hospital with their wards while only some 3.7% (2/54) have to travel for more than an hour to the hospital in seeking treatment.

Table 11: Distance to Agogo Hospital (min.)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	≤30 min.	29	49,2	53,7	53,7
	>30 mins. & <60 mins.	23	39,0	42,6	96,3
	> 60 min.	2	3,4	3,7	100,0
	Total	54	91,5	100,0	
Missing	System	5	8,5		
Total		59	100,0		

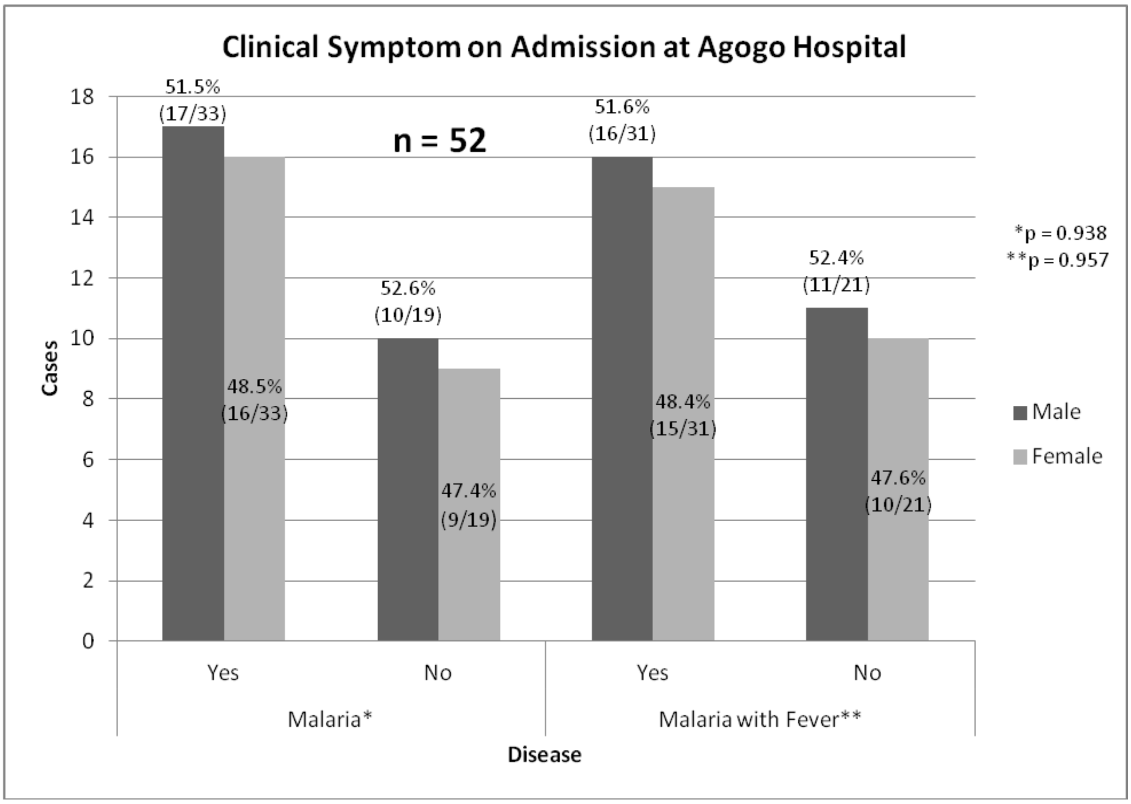


Figure 38: Clinical symptom on admission at Agogo Hospital by Gender- Malaria & Malaria with Fever

Out of the 52 patients who participated in the study at Agogo Hospital, 33 showed symptoms of malaria on admission while 19 did not. Of those who showed Sympstoms of malaria on admission, 51.5% (17) and 48.5% (16) were males and females respectively. Of the 52 patients, 31 manifested fever with malaria whereas 21 did not. Out of the 31 patients 51.6% (16) and 48.4% (15) were males and females respectively as shown in figure 38 above.

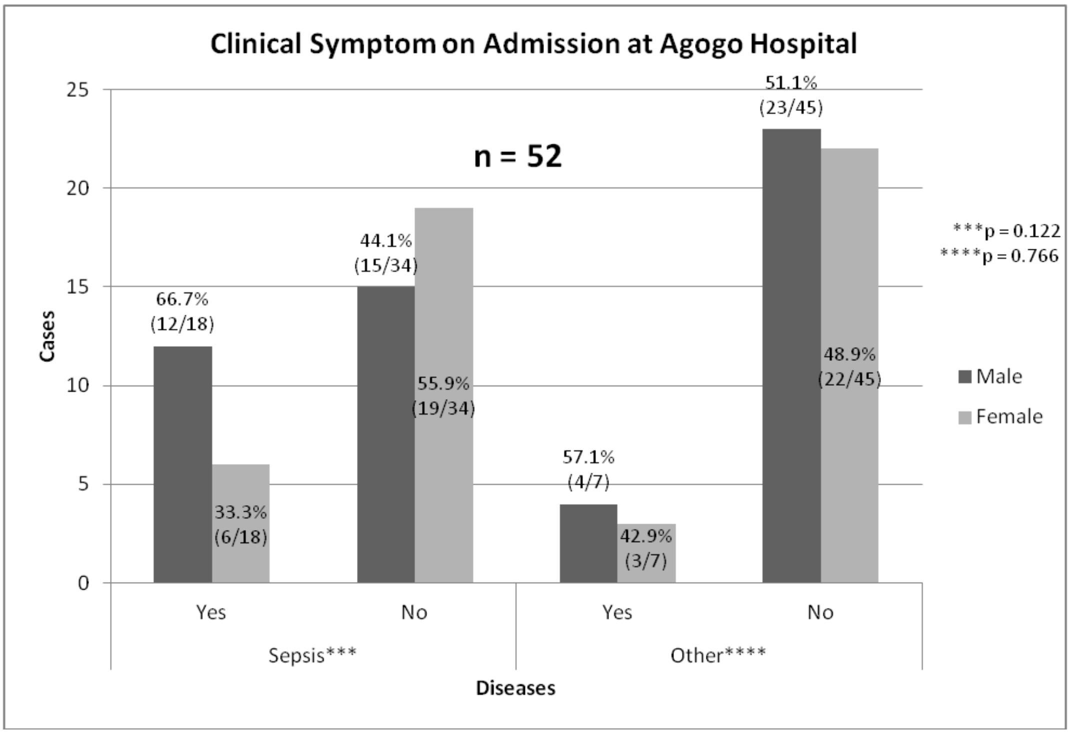


Figure 39: Clinical symptom on admission at Agogo Hospital by Gender - Sepsis & other

Among those patients who reported with clinical symptoms on admission, 18 manifested symptoms of sepsis and 34 did not. Among those who showed symptoms of sepsis, 66.7% (12/18) and 33.3% (6/18) were males and females respectively whereas from amongst those who showed other clinical symptoms made up 7 and those who did not show any other symptom were 45. Out of this 7 patients 57.1% (4/7) and 42.9% (3/7) were males and females respectively (see figure 39).

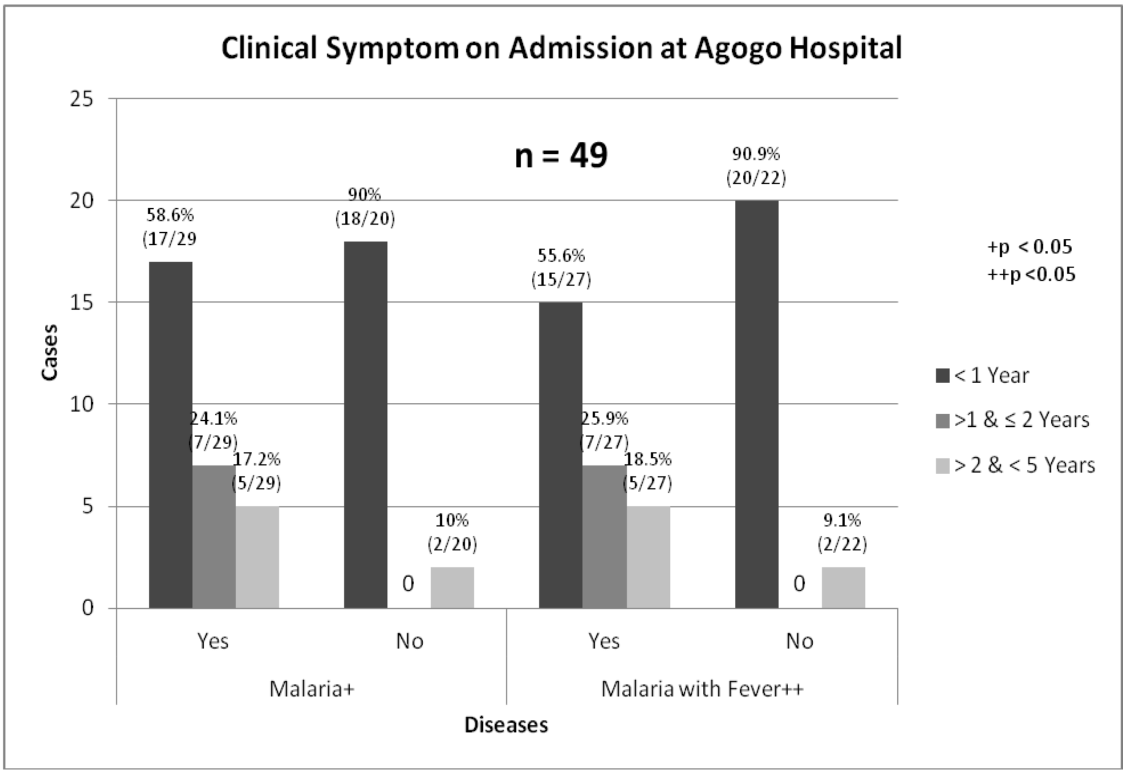


Figure 40: Clinical symptom on admission at Agogo Hospital by Age Groupings - Malaria & Malaria with Fever

Analysing clinical symptoms on admission on the lines of age groups, we can see from figure 40 that out of the total number of 49 who participated in the study at Agogo Hospital, 29 showed symptoms of malaria whereas 20 did not. Out of those who manifested symptoms of malaria on admission, patients under 1 year of age were 58.6% (17) followed by those older than 1 year and 2 years or younger with 24.1% (7) and then comes those older than 2 years and younger than 5 years with 17.2% (5). Age seems to be a significant predictor of both malaria and fever with malaria on admission as shown by the statistical test.

Figure 41 shows that, out of the total number of 49 patients who reported at the Agogo Hospital, 18 showed symptoms of sepsis on admission while 31 did not have any sepsis. Fifteen out of the 18 patients who showed symptom of sepsis, 83.3% (15/18) were children under 1 year; followed by those older than 2 years and younger than 5 years (11.1% [2/18]) and those older than 1 year and 2 years or younger represented 5.6% (1/18) of sepsis cases recorded on admission. Only 6 out the total number of patients who participated in the study at Agogo Hospital showed other symptoms on admission.

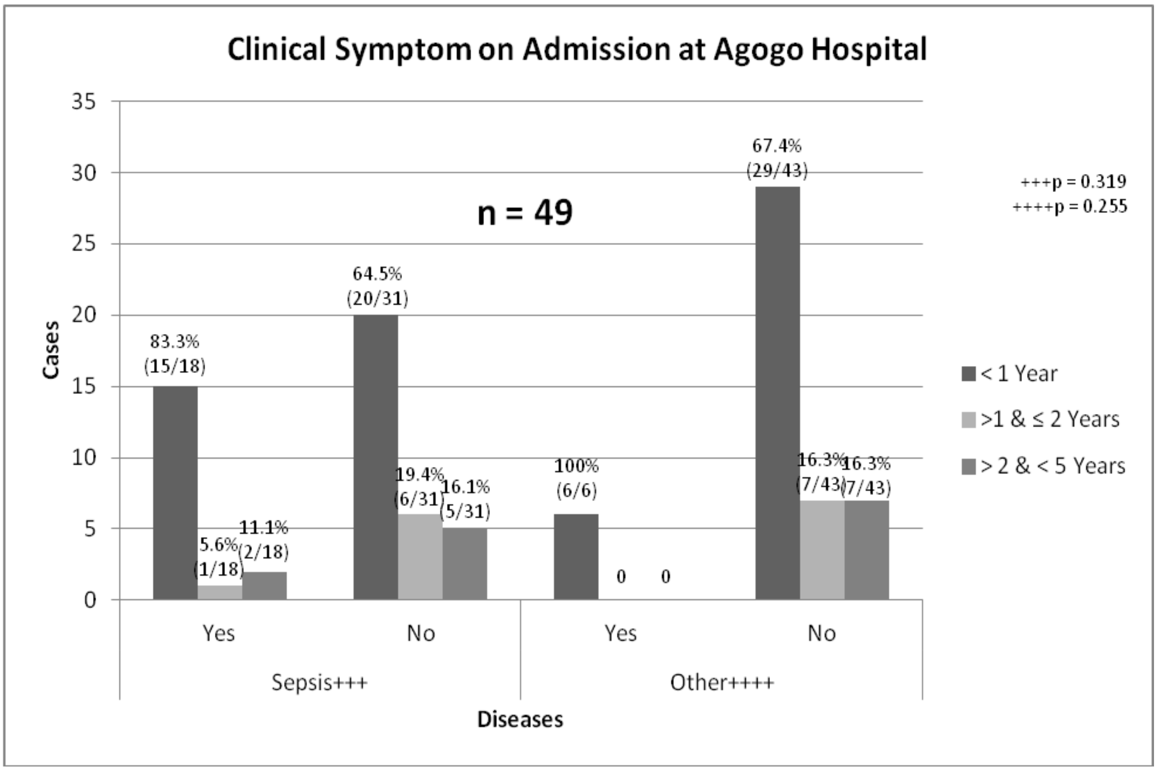


Figure 41: Clinical symptom on admission at Agogo Hospital by Age Groupings - Sepsis & other

About 81.5% (44/54) of the care-givers who took their wards for treatment at Agogo Hospital had a health insurance coverage with 18.5% (10/54) not having a health insurance coverage meaning they have to pay out of their pockets for the treatment of their wards.

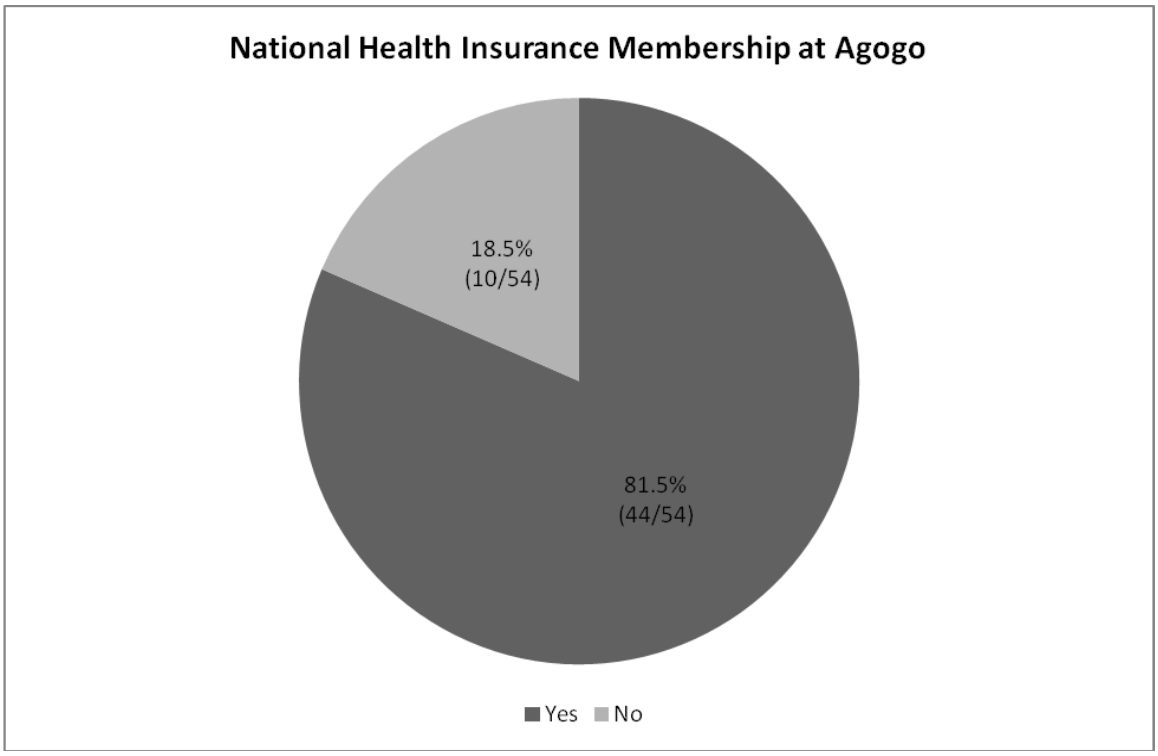


Figure 42: Health insurance membership for parents of patients at Agogo Hospital

Table 12: Educational level of parents accompanying children to Agogo Hospital

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary or no education	30	50,8	55,6	55,6
	Junior High School	17	28,8	31,5	87,0
	Senior High School or Tertiary	7	11,9	13,0	100,0
	Total	54	91,5	100,0	
Missing	System	5	8,5		
	Total	59	100,0		

From table 12, it will be noted that 55.6% (30/54) of the care-givers who brought their wards to the Agogo Hospital had basic education or no formal education at all with 31.5% (17/54) having visited the Junior High School. Only 13% (7/54) visited the senior high school or any tertiary institution.

Table 13: Social status of parents accompanying children to Agogo Hospital

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	53	89,8	98,1	98,1
	Divorced or Widowed	1	1,7	1,9	100,0
	Total	54	91,5	100,0	
Missing	System	5	8,5		
Total		59	100,0		

Out of the 54 care-givers who accompanied the children to the Pramso Hospital, 98.1% (53/54) were married with those being divorced or widowed each representing 1.9% (1/54). No ward was brought to the Agogo Hospital by a single other or father as shown in table 13.

Table 14: Number of children to a parent accompanying a child to Agogo Hospital

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 to 2 children	32	54,2	60,4	60,4
	2 to 4 children	11	18,6	20,8	81,1
	5 or more children	10	16,9	18,9	100,0
	Total	53	89,8	100,0	
Missing	System	6	10,2		
Total		59	100,0		

Most of the parents (60.4% [32/53]) who accompanied their wards to the hospital had 1 to 2 children with 20.8% (11/53) and 18.9% (10/53) having 2 to 4 and 5 or more children respectively as shown in table 14.

Table 15: Occupation of parents accompanying a child to Agogo Hospital

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employed	50	84,7	92,6	92,6
	Unemployed	4	6,8	7,4	100,0
	Total	54	91,5	100,0	
Missing	System	5	8,5		
Total		59	100,0		

Most of the care-givers (92.6% [50/54]) who accompanied their wards to the Agogo Hospital were gainfully employed and only 7.4% (4/54) were unemployed.

7.2.2 Inferencial Statistics

Table 16: Cross tabulation of age groupings and malaria slide analysis for Agogo Hospital

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age groupings of patients * Malaria slide analysis result	48	81,4%	11	18,6%	59	100,0%

Age groupings of patients * Malaria slide analysis result Crosstabulation

			Malaria slide analysis result		Total
			Positive	Negative	
Age groupings of patients	Under 1 year	Count	10	24	34
		% within Malaria slide analysis result	52,6%	82,8%	70,8%
	Older than 1 year but less than or equal to 2 years	Count	6	1	7
		% within Malaria slide analysis result	31,6%	3,4%	14,6%
	Older than 2 years but less than 5 years	Count	3	4	7
		% within Malaria slide analysis result	15,8%	13,8%	14,6%
Total		Count	19	29	48
		% within Malaria slide analysis result	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7,731[a]	2	,021
Likelihood Ratio	7,947	2	,019
Linear-by-Linear Association	2,157	1	,142
N of Valid Cases	48		

a. 4 cells (66,7%) have expected count less than 5. The minimum expected count is 2,77.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	,401	,021
	Cramer's V	,401	,021
N of Valid Cases		48	

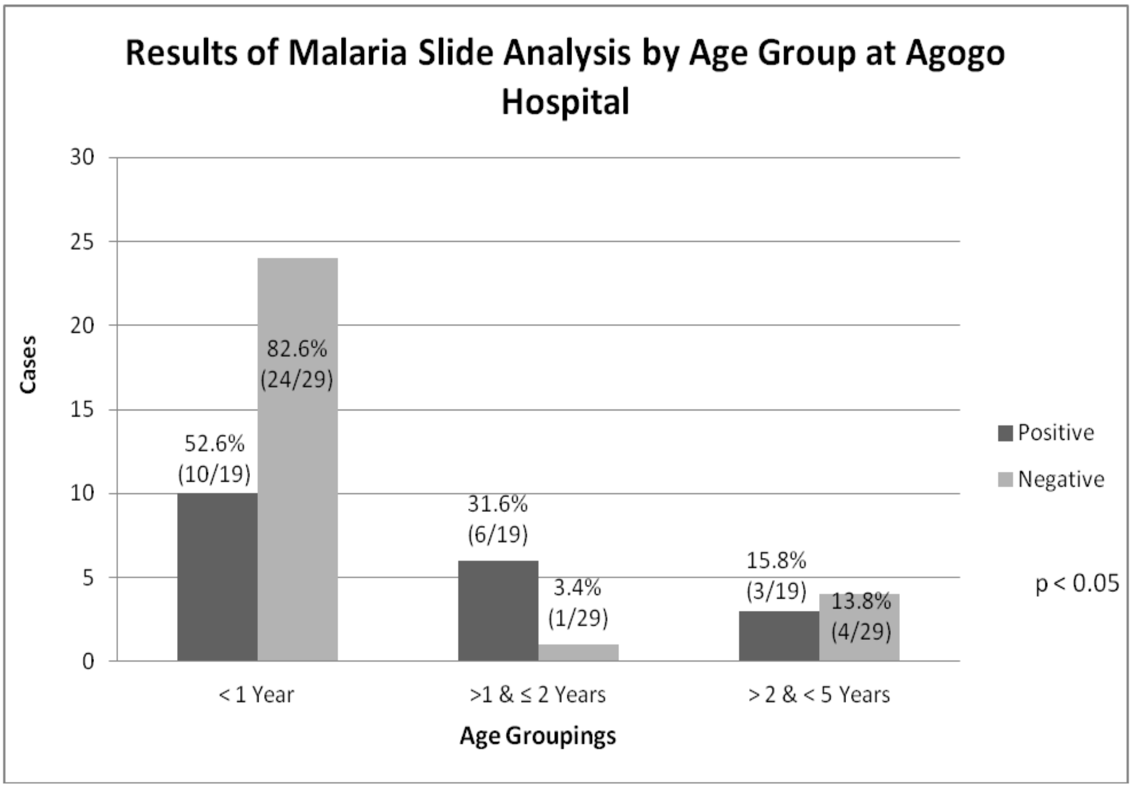


Figure 43: Malaria slide analysis and age for Agogo Hospital

Table 16 above shows that of the 19 patients who tested positive after the malaria analysis from 48 malaria slides, 52.6% (10/19) of patients under 1 year tested positive followed by those older than 1 year and 2 years or younger with 31.6% (6/19) whereas those older than 2 years and younger as 5 years make up 15.8% ([3/19]) of the patients.

Table 17: Cross tabulation of gender and malaria slide analysis for Agogo Hospital

			Malaria slide analysis result		Total
			Positive	Negative	
Gender of patient	Male	Count	10	16	26
		% within Malaria slide analysis result	47,6%	53,3%	51,0%
	Female	Count	11	14	25
		% within Malaria slide analysis result	52,4%	46,7%	49,0%
Total		Count	21	30	51
		% within Malaria slide analysis result	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,161[a]	1	,688		
Continuity Correction[b]	,014	1	,907		
Likelihood Ratio	,161	1	,688		
Fisher's Exact Test				,779	,453
Linear-by-Linear Association	,158	1	,691		
N of Valid Cases	51				

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 10,29.

b. Computed only for a 2x2 table

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-,056	,688
	Cramer's V	,056	,688
N of Valid Cases		51	

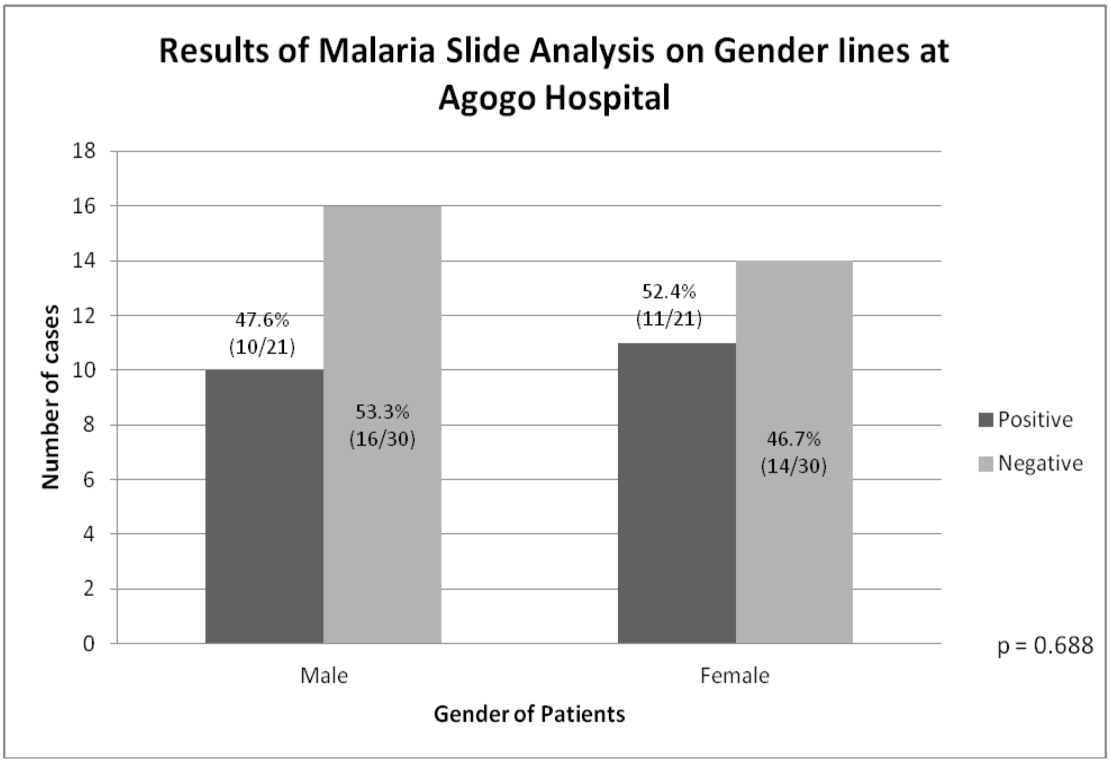


Figure 44: Malaria slide analysis and gender for Agogo Hospital

From the above table one could see that among those patients, who tested positive from the malaria slide analysis out of the 51 patients, females made up 52.4% (11/21) and males make up 47.6% (10/21). Though female tested mostly positive in the malaria slide analysis gender has no significant influence on the test outcome.

On discharge from the Agogo Hospital, pediatricians rated the recovery status of 35 of their patients as "very good" out of the total number of 51 patients. Out of the 35 patients about 65.7% (23) who stayed in the admission ward for one to three days had a very good recovery status on discharge followed by those who stayed for four to six days with 28.6% (10) and 5.7% (2) who stayed for a week or more were rated as having a very good recovery status. However 12 other patients were rated to have a "good" recovery status of whom 50% (6) stayed in admission for four to six days before been discharged whereas 33.3% (4) of those rated with "good" recovery status stayed for one to three days before being discharged with the rest (thus 16.7% (2) stayed for seven days or more before discharge (refer to table 18).

Table 18: Cross tabulation of time spent in Agogo Hospital and recovery status on discharge

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Time spent in hospital * Recovery status on discharge	51	86,4%	8	13,6%	59	100,0%

Time spent in hospital * Recovery status on discharge Crosstabulation

			Recovery status on discharge			Total
			Very good	Good	Very bad	
Time spent in hospital	1 - 3 days	Count	23	4	4	31
		% within Recovery status on discharge	65,7%	33,3%	100,0%	60,8%
	4 - 6 days	Count	10	6	0	16
		% within Recovery status on discharge	28,6%	50,0%	,0%	31,4%
	7 days or more	Count	2	2	0	4
		% within Recovery status on discharge	5,7%	16,7%	,0%	7,8%
Total		Count	35	12	4	51
		% within Recovery status on discharge	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7,016[a]	4	,135
Likelihood Ratio	8,235	4	,083
Linear-by-Linear Association	,402	1	,526
N of Valid Cases	51		

a. 6 cells (66,7%) have expected count less than 5. The minimum expected count is ,31.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	,371	,135
	Cramer's V	,262	,135
N of Valid Cases		51	

7.2.3 Economic Analysis for Agogo

Figure 45 shows that care-givers' willingness to pay for the laboratory investigation and medical cost lies below GH¢ 20.00 New Ghana Cedis (US$ 11.71) with the amount paid for these services plus other indirect medical care cost like transport cost in real sense being far above GH¢ 20.00 New Ghana Cedis threshold. In some rare cases the care-giver willingness to pay for the laboratory and drug costs corresponds with the cost of treatment on the ground but this does not stipulate their ability to pay for those services.

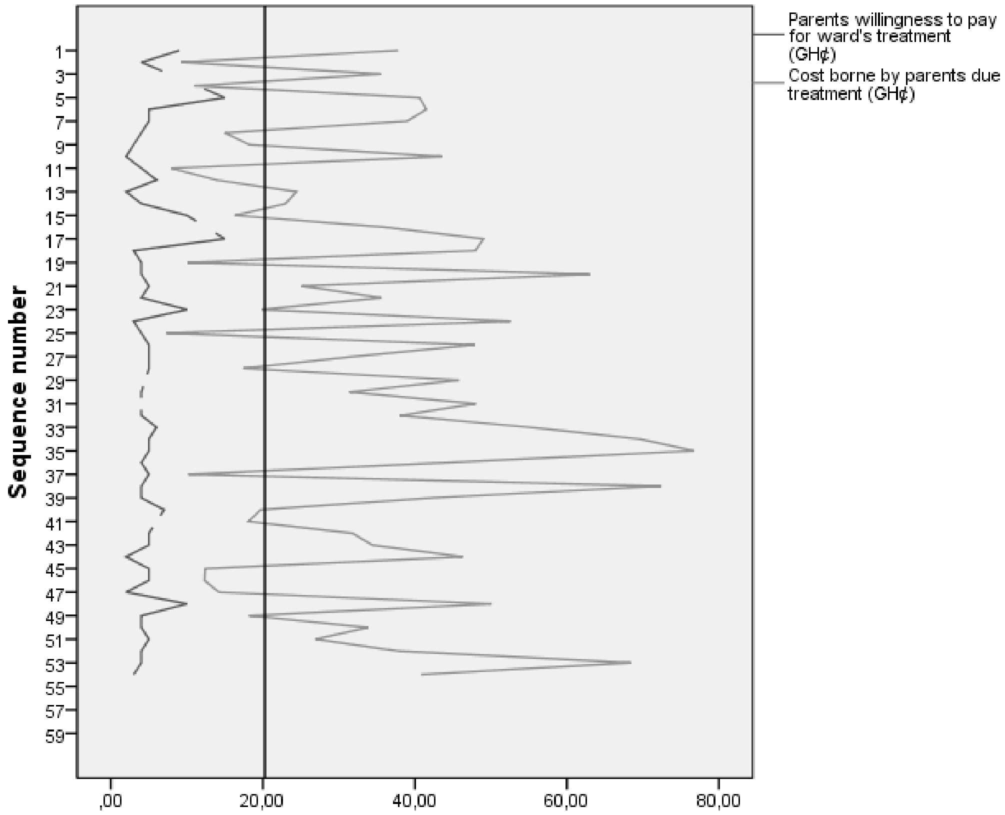


Figure 45: Caseplot showing Willingness-To-Pay and total cost of treatment at Agogo Hospital

Looking at figure 46 one could say that the cost of laboratory investigation and drugs alone is in the reach of care givers willingness to pay. This implies that the real cost of laboratory investigation and that of drugs is to some extend affordable for the care-givers who take their wards to Agogo Hospital for treatment. This is because the threshold cost for both willingness to pay for the laboratory services and drugs as well as that of the actual cost of drugs and laboratory charges lies below GH¢ 20 New Ghana Cedis (US$ 11.70) with some overlap of the actual costs lying above the GH¢ 18.00 New Ghana Cedi Threshold. One could notice the intermingling issue of the care-givers gauge of paying for the laboratory and drug costs in the sense that the minimum value of the care-givers willingness to pay for the laboratory investigation was GH¢ 2.00 (US$ 1.17) and the maximum being GH¢ 15.00 (US$ 8.78) which corresponds with the laboratory service charges.

However the minimum and maximum costs of the laboratory and drugs happened to be GH¢ 1.80 New Ghana Cedi (US$ 1.05) and GH¢ 70.70 New Ghana Cedis (US$ 41.39) respectively.

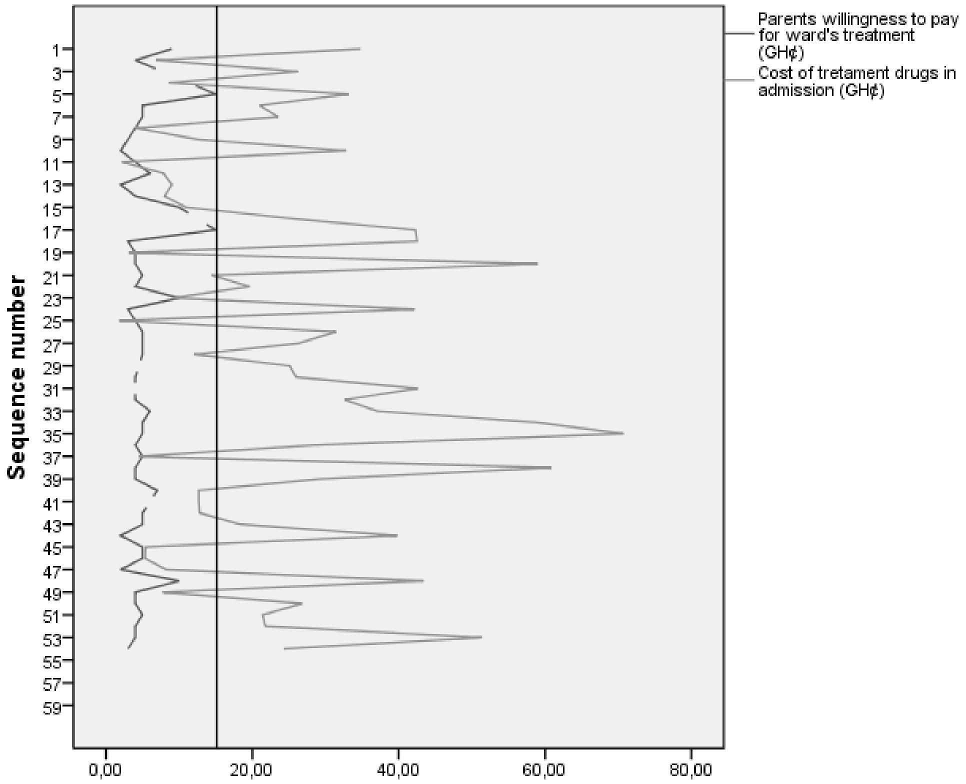


Figure 46: Caseplot showing Willingness-To-Pay and cost of treatment drugs and laboratory analysis at Agogo Hospital

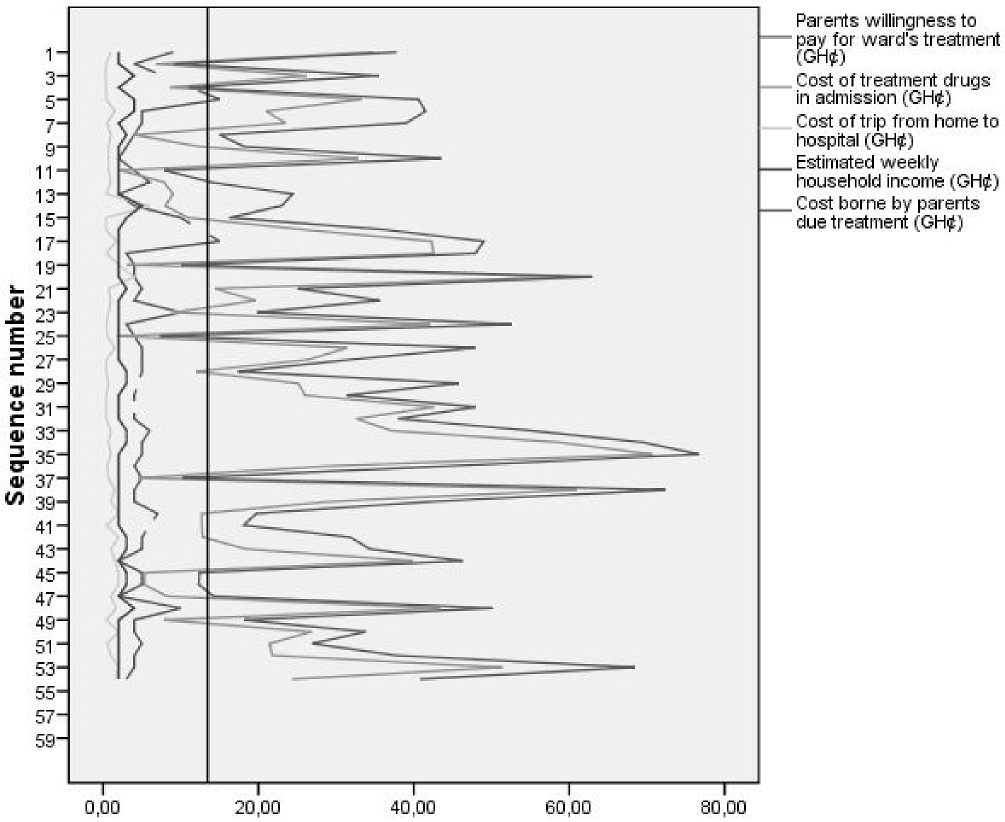


Figure 47: Caseplot comparing all cost and income at Agogo Hospital

Figure 47 shows that all the other cost aspects including the weekly income of a household though lies below the threshold amount of GH¢ 17 New Ghana Cedis (US$ 9.95), the costs of treatment and drugs nears the total cost of treatment which both relates to the care-givers willingness to pay. This implies that, irrespective of the cost differences but the price of treatment is to some extent affordable for care-givers taking their children to the hospital.

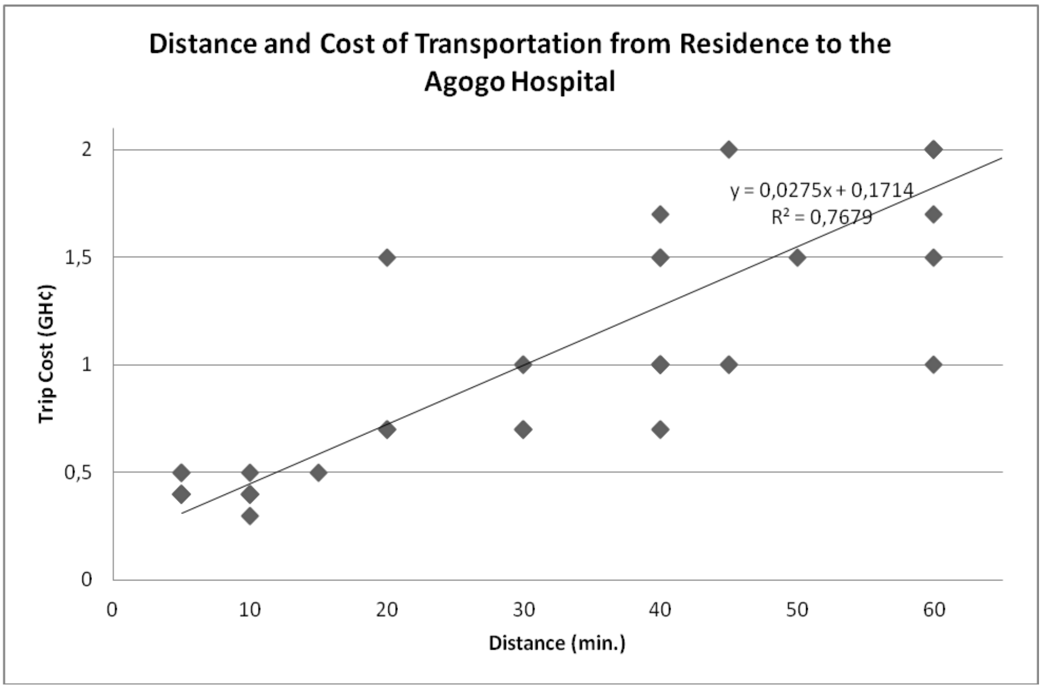


Figure 48: Scatter plot displaying the relationship between distance to Pramso Hospital and cost of transportation at Agogo

There seems to be a strong relation between the distance taking to the Agogo Hospital and the cost of transportation as 76% of the proportion of variance in the cost of transportation to Agogo Hospital is explained by the distance to the hospitals depicted in figure 48 above.

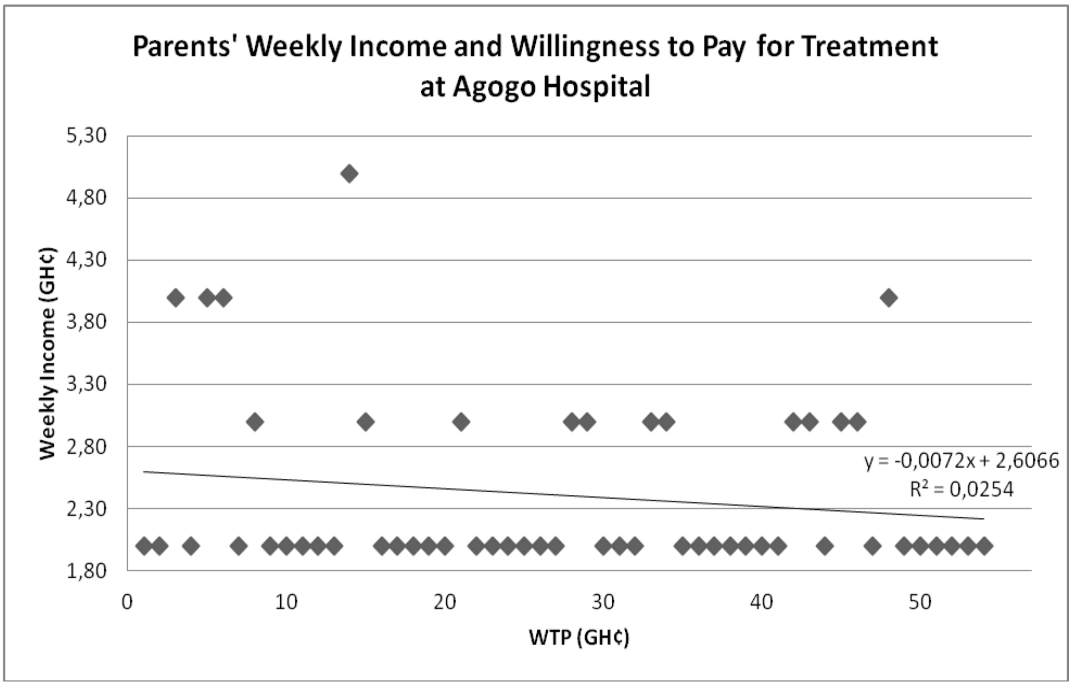


Figure 49: Scatter plot showing relationship between weekly income and willingness to pay for treatment at Agogo

There seem to be a weaker relation between weekly household income and willingness to pay as only 3% of the proportion of the variance in weekly household income can be explained by the care-givers' willingness to pay as shown in figure 49.

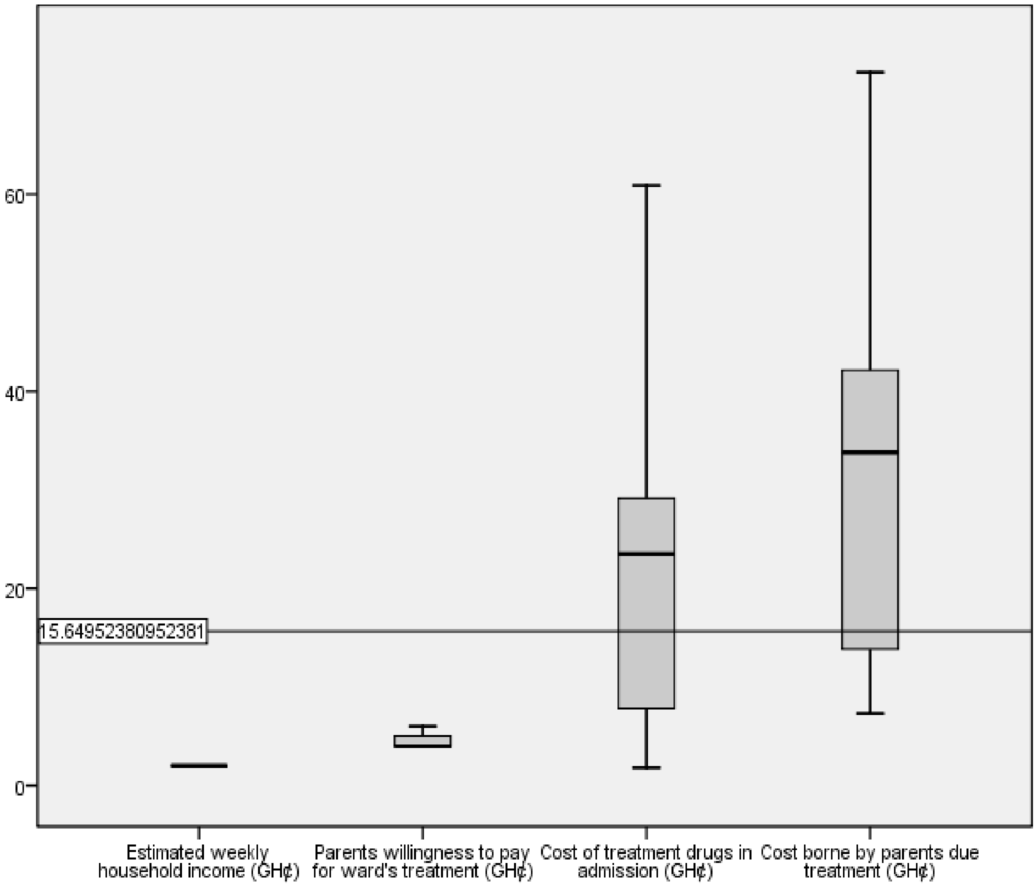


Figure 50: Comparison of the Income and Cost of Parents at Agogo Hospital after adjusting for outliers

The diagram above testifies to the fact that care-givers willingness to pay for the treatment of their wards corresponds to some extent with the costs of laboratory investigation and drugs. This implies that some of the care-givers will be able to afford paying out of their pocket even without any intervention from the side of the government or private donors. One could see that most part of the caseplot for the cost for laboratory investigation and drug (tagged "cost of treatment drugs in admission") lies within the same range with the "parents willingness to pay for ward's treatment" and some part of the total cost borne by parents due to treatment also lies with the range all below the threshold average of GH¢ 16 New Ghana Cedi (US$ 9.37).

Comparing only the "cost of treatment drugs in admission" to the "parents willingness to pay for ward's treatment" on the plot in figure 46, one could see that the average willingness to pay for ward's treatment (GH¢ 5 New Ghana Cedis (US$ 2.93)) is half of the average of the cost of treatment drugs in admission GH¢ 10 New Ghana Cedis (US$ 5.85).

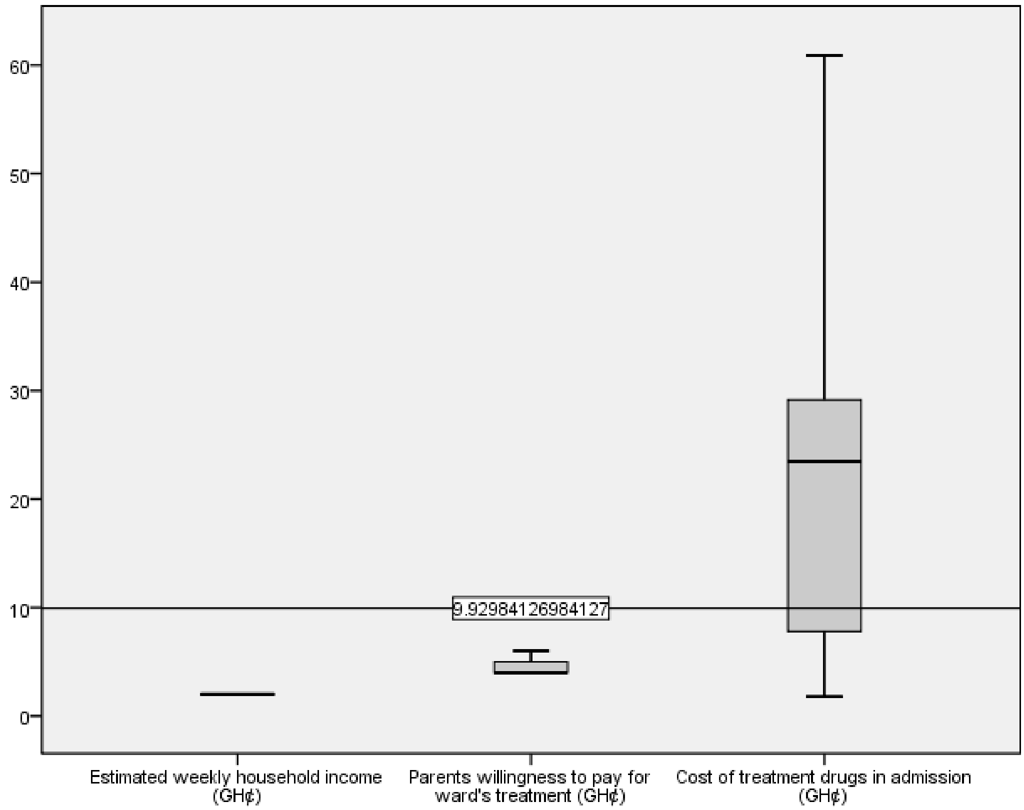


Figure 51: Comparison of the income, WTP and Cost of treatment at Agogo Hospital

From table 19, we could see that there was a fair representation of treatment charges to the number of patients during their admission, though those who paid between GH¢ 9.16 to GH¢ 29.15 New Ghana Cedis (US$ 5.36 to US$ 17.07) were the majority with 21; those who paid GH¢ 1 to GH¢ 9.15 and GH¢ 29.16 New Ghana Cedis (US$ 5.36 to US$ 17.07) or more were represented with the same number of patients (15 each). Out of the 21 care-givers who paid for their ward's treatment, 71.4% (15) had their wards admitted for one to three days in the pediatric ward of the Agogo Hospital with the rest (28.6% [6]) having their wards stay in admission for four to six days. The rest also followed the same trend having most of their wards stay in the pediatric ward for one to three days or four to six days with a percentage of 60 and 46.7 for those who paid GH¢ 29.16 or more and GH¢ 1 to GH¢ 9.15 respectively. Only 13% (2) for both care-givers who paid GH¢ 29.16 or more and GH¢ 1 to GH¢ 9.15 was recorded had their wards stay for a week or more in the pediatric ward.

From the analysis done total cost was GH¢ 1,191.38 New Ghana Cedis (US$ 697.52) and total benefit was is GH¢ 669.60 New Ghana Cedis (US$ 392.03). Putting these figures in equation 2 we arrive at the following:

Net Benefit = GH¢ 669.60 - GH¢ 1,191.38

Net benefit is therefore: minus GH¢ 530.70 (minus US$ 310.71)

Since the net benefit for the diagnostic system at Agogo Hospital is negative the conversational diagnostic system has no value for money.

Table 19: Length of stay and cost of treatment at Agogo Hospital

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Time spent in hospital * Treatment cost categorised	51	86,4%	8	13,6%	59	100,0%

Time spent in hospital * Treatment cost categorised Crosstabulation

			Treatment cost categorised			Total
			1 - 9.15 GH¢	9.16 - 29.15 GH¢	29.16 GH¢ or more	
Time spent in hospital	1 - 3 days	Count	7	15	9	31
		% within Treatment cost categorised	46,7%	71,4%	60,0%	60,8%
	4 - 6 days	Count	6	6	4	16
		% within Treatment cost categorised	40,0%	28,6%	26,7%	31,4%
	7 days or more	Count	2	0	2	4
		% within Treatment cost categorised	13,3%	,0%	13,3%	7,8%
Total		Count	15	21	15	51

Table 19: Length of stay and cost of treatment at Agogo Hospital

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
% within Treatment cost categorised	100,0%	100,0%	100,0%	100,0%		

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4,199[a]	4	,380
Likelihood Ratio	5,645	4	,227
Linear-by-Linear Association	,322	1	,570
N of Valid Cases	51		

a. 5 cells (55,6%) have expected count less than 5. The minimum expected count is 1,18.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	,287	,380
	Cramer's V	,203	,380
N of Valid Cases		51	

7.2.4 Satisfaction Survey for Agogo Hospital

The satisfaction survey of the care-givers who accompanied their wards to the Agogo Hospital (results in fiogures 52, 53 and 54) shows that care-givers were "very satisfied" with all services offered them during the admission of their

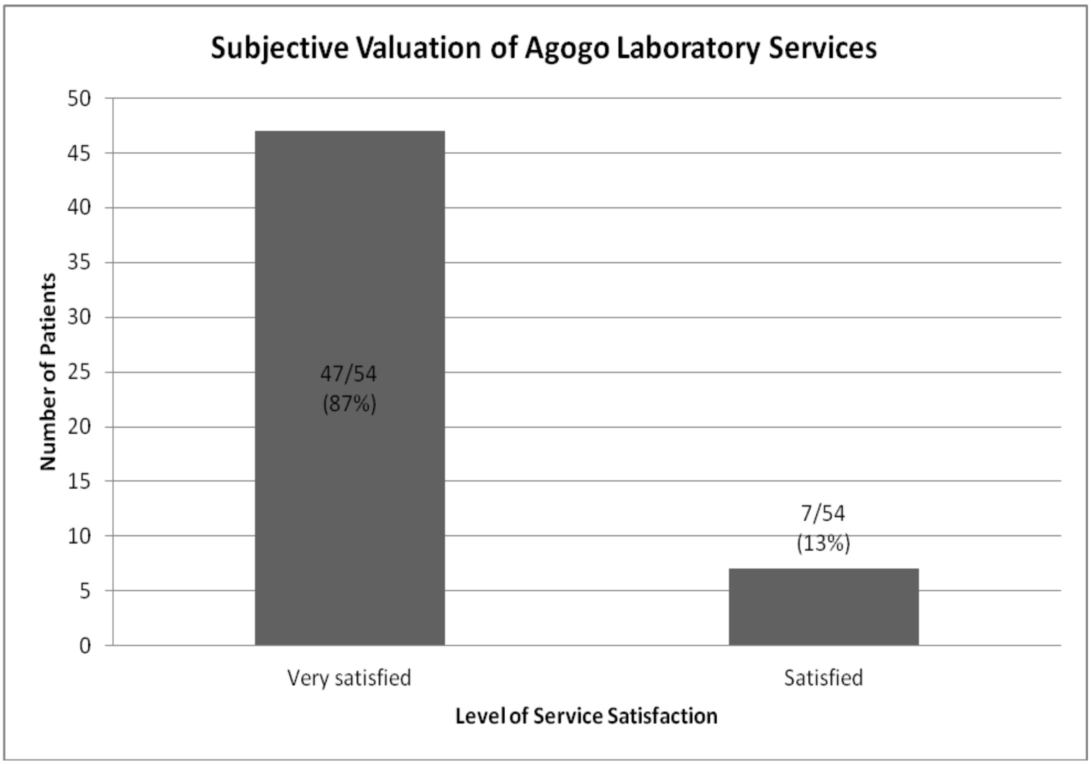


Figure 52: Satisfaction survey on the services of Agogo Hospital laboratory

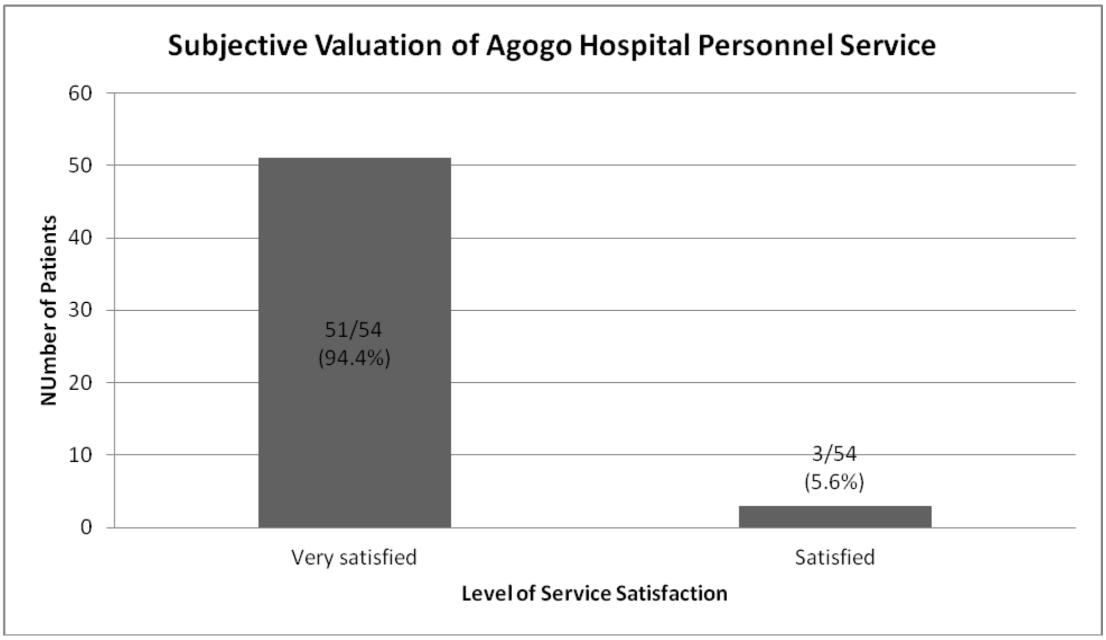


Figure 53: Satisfaction survey on the services of Agogo Hospital personnel

wards in the pediatric ward. Of the 54 care-givers interviewed 87% (47/54) said to be "very satisfied" with the laboratory services offered them at Agogo Hospital, 94.4% (51/54) said they were "very satisfied" with personnel services and 98.1% (53/54) said to be "very satisfied" with the treatment offered their wards during their admission at the hospital. The rest of the care-givers from across all the service categories said to be "satisfied" with the services of the hospital.

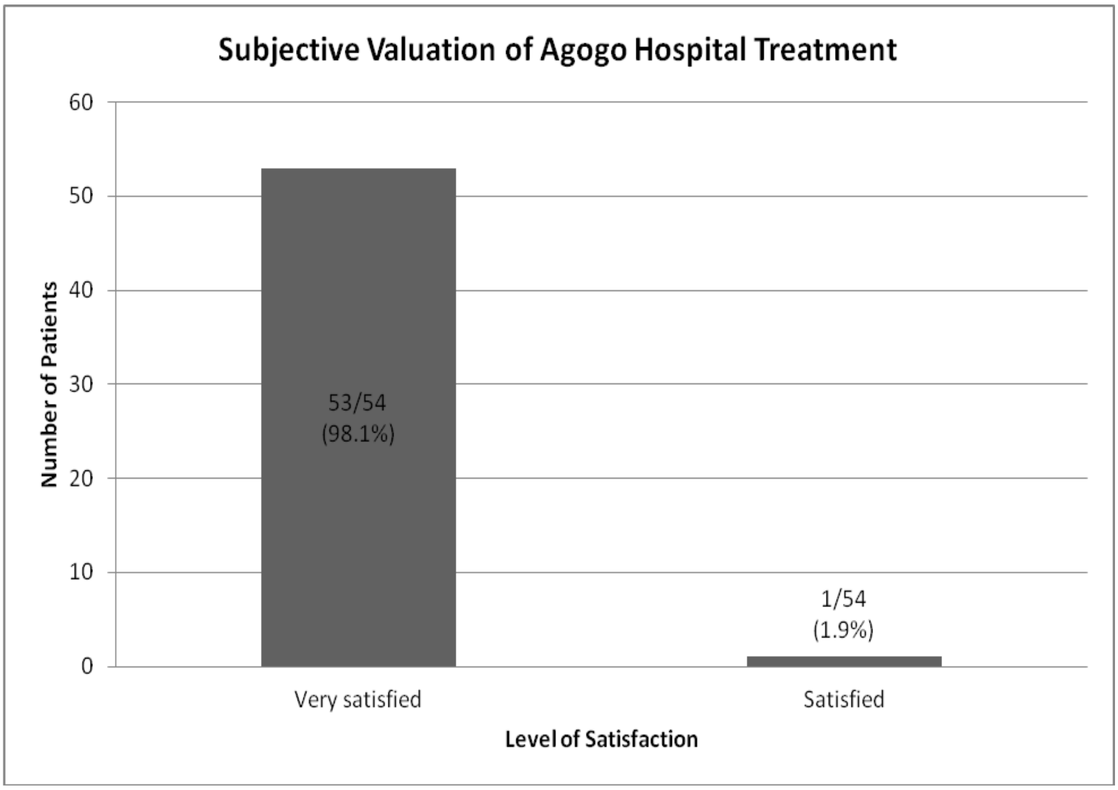


Figure 54: Satisfaction survey on the services of Agogo Hospital treatment

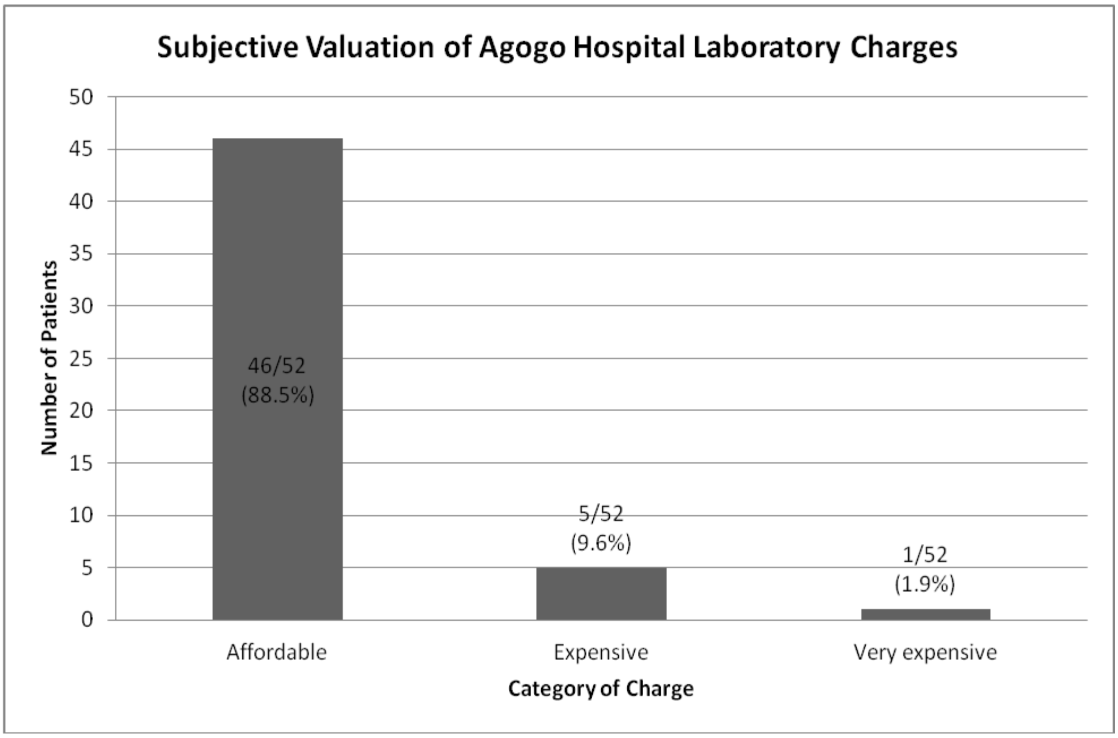
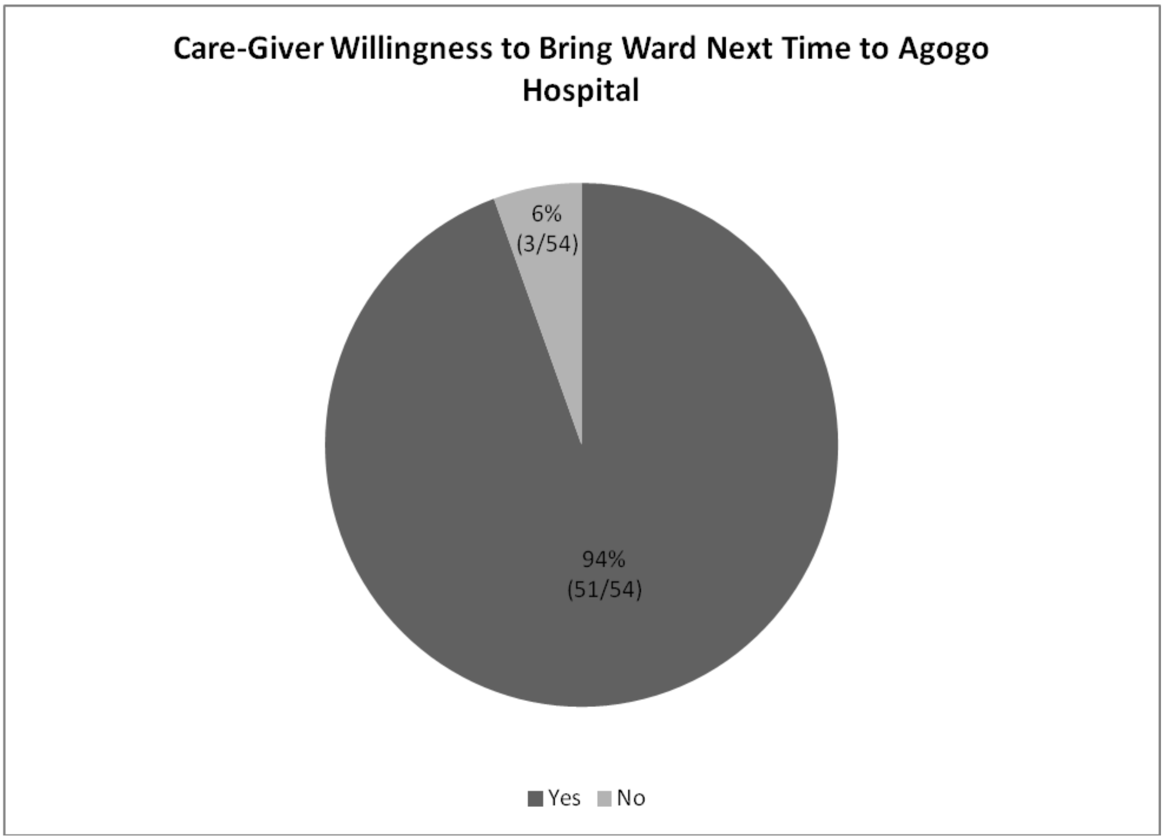


Figure 55: Valuation of Agogo Hospital laboratory charges



Most of the care-givers interviewed (88.5% [46/52]) on laboratory charges of the Agogo Hospital said the cost of laboratory investigations were "affordable". Others said the charges were "expensive" (9.6% [5/52]) with only 1.9% (1/52) saying the charges were "very expensive".

Furthermore of the 54 care-givers who answered the question of the "willingness to bring their ward to the Agogo Hospital next time the child is ill", 94% (51/54) answered with "YES" and 6% (3/54) answered with "NO".

8 Results

The average age of patients who participated in the studies for both Pramso and Agogo Hospitals was 2 years of age. Large disparity between the gender of patients at Pramso Hospital since males represented 60% and females 40% but the gender of participants at Agogo Hospital was fairly represented with males making up 52% and females being 48%.

Care-givers (parents or guardians) of study participants at Pramso Hospital earn on average twice as much as their counterparts at Agogo Hospital with GH¢ 16.00 and GH¢ 8.00 respectively per month. This could be an explaining factor in the higher willingness to pay for treatment from the side of care-givers at Pramso Hospital than those at Agogo Hospital since those at Pramso were willing to pay on average GH¢ 9 New Ghana Cedis for laboratory and drug costs whilst those at Agogo were willing to pay on average GH¢ 5 New Ghana Cedis.

However care-givers at Pramso Hospital end up paying GH¢ 37.00 New Ghana Cedis to cover the treatment cost (cost for laboratory and drugs) from admission to discharge of their wards but those at Agogo pay GH¢ 24.00 New Ghana Cedis to cover the same service for treatment.

Parents or guardians who visited the Pramso Hospital rushed their children to the hospital within 2 days of symptom manifestation while those at Agogo did that within 3 days from symptom start. In so doing care-givers who took their wards to the Pramso Hospital had to travel for 58 minutes on average to the hospital costing them GH¢ 1.30 New Ghana Cedis while those who took theirs to the Agogo Hospital had to travel for 33 minutes to the hospital where they have to bear GH¢ 1.00 New Ghana Cedis. This shows that distance from place of residence to the hospital in both cases, for Pramso and Agogo, has an impact on the cost of transportation as those who travelled far have to pay much than those who traveled within a short distance.

When asked to trade perfect health condition of their children to moments of pain and "dis-ease", care-givers at Pramso Hospital said they will be satisfied if their wards had on average 3-day relief from pain due to their sickness with the help of laboratory investigations whereas their counterparts at Agogo Hospital said having on average 2-day pain relief from "dis-ease" will be satisfactory for their wards.

Mostly children under 1 year of age were admitted to the pediatric wards of the two hospitals under study but those at Agogo Hospital made up 71.4% (35/49) of all the children who were admitted while those at Pramso Hospital made up 44.6% (29/65) of all the children who were admitted. At Pramso Hospital however, children older than 1 year and 2 years or younger made up the second largest group of those admitted with 29.2% (19/65) and those older than 2 years and younger than 5 years made up 26.2% (17/65).

Male children admitted to both hospitals showed most symptoms of malaria with those at Pramso Hospital representing 61.4% (35/57) and females making up 38.6% (22/57). In the case of Agogo Hospital males made up 51.5% (17/33) and females 48.5% (16/33).

Among children screened on admission for fever and malaria combined, males and females fairly showed the combined symptoms at Agogo Hospital with 51.6% (16/31) and females represented 48.5% (16/33) of the same case. At Pramso Hospital males who showed same combined symptoms (fever and malaria) were 64.3% (18/28) and females represented 35.7% (10/28).

At Pramso Hospital 66.7% (18/27) of male patients were screened with sepsis while 33.3% (9/27) of the females out of 64 cases were screened for the same case. Agogo Hospital however recorded 66.7% (12/18) sepsis cases on admission for males and 33.3% (6/18) for females out of the total number of 52 cases reported on admission.

Moreover, age had a significant influence on contraction of malaria alone or having fever with malaria combined among the children at Agogo Hospital. A significant effect was seen amongst children under 1 year of age showed malaria symptoms on admission (58.6% [17/29]; +p<0.05) and those who showed symptom of malaria with fever combined (55.6% [15/27]; ++p<0.05) at Agogo Hospital whereas no significant effect of age was seen for the same age group at Pramso Hospital. This implies that age as an effect in contracting "malaria" or "fever with malaria" for children admitted at Pramso Hospital.

No significant effect of age was seen for symptoms of sepsis or other cases for children recruited in both hospitals (Pramso: Sepsis ^p=0.761; Other cases ^^p=0.739 & Agogo: Sepsis +++p=0.319; Other cases ++++p=0.255).

Furthermore, care-givers of children recruited at Pramso Hospital had to a large extent a health insurance coverage than those at Agogo Hospital (Pramso: 91% (58/64) & Agogo: 81.5% (44/54)). It is worth noticing that a number of care-givers at both hospitals were not insured which implies that those care-givers have to make out of pocket payment to receive health care for their wards during admission. Again, lack of resources to personally cover the costs of treatment can pose serious problems to further deteriorate the health condition of the wards of those care-givers lacking health insurance coverage. This is because lack of coverage might delay the on-time visit to the hospital with the children. Nine percent (6/64) of care-givers at Pramso lack coverage and those at Agogo Hospital 18.5% (10/54) lack coverage.

Age had no effect on the malaria test results for Pramso Hospital (χ^2[63]=3.599; p=0.165) but on the malaria test results of Agogo Hospital (χ^2[48]=7.731; p<0.05). At Agogo, mostly children under 1 year of age tested positive for malaria (52.6% [10/19]) followed by those older than 1 year and 2 years or younger with 31.6% (6/19) and those older than 2 years and amongst those younger than

5 years 15.8% (3/19) tested positive out of the total of 48 slides after laboratory investigation had been conducted at Agogo Hospital by the microbiological diagnostic equipments.

In both hospitals, gender did not have any significant impact on the malaria test results (Pramso: p=0.493 and Agogo: p=0.688).

Furthermore, the length of stay did not have any significant effect on the recovery of the children admitted in both hospitals (Pramso: p=0.397 and Agogo: p=0.135).

Length of stay in admission ward of a hospital has a significant impact on the cost that care-givers have to bear for the treatment of their children as seen for at Pramso Hospital but not at Agogo Hospital (Pramso: $\chi^2[68]=14.290$; $p<0.05$ & Agogo: $\chi^2[51]=4.199$; p=0.380).

Care-givers at Agogo Hospital were willing to pay for a realistic price for the treatment that their wards have to receive since the value of their "WTP" was closely related to the actual cost of treatment that care-givers have to borne during the admission of their children at that hospital whereas a wider gap exist between the two indicators at Pramso Hospital.

A higher level of satisfaction was seen among care-givers at Agogo Hospital than among their counterparts at Pramso Hospital.

Lastly the costs of treatment is in general too high for the affordability of care-givers at Pramso Hospital though most of them said the cost of treatment is "affordable" since the net benefit showed a negative value of minus one hundred and fifty-four. Similar outcome was found for Agogo but the net benefit value for Pramso is a lower than that of Pramso (Agogo: minus GH¢ 530.70 (minus US$ 310.71) & Pramso: minus GH¢ 153.80 (minus US$ 90.05)).

9 Discussion and Recommendation

In developing the instruments for collecting the data for this research work, I considered the level of education of the local people of both townships since they are located in the rural areas of the research setting. This made me asked the parents or guardians about how much their entire household earn for living in a week and their monthly household income. This will allow the care-givers to easily estimate their earnings and not to take much time in thinking which could call for recall bias.

Net benefit analysis (NBA) was employed in determining the value for money of the two diagnostic systems, the standard and the conventional, since only point estimates or data were collected for each hospital without any follow-up data from the timeline. This allows us the use the cost and effect data of one diagnostic system in calculating the cost-benefit of the of it. incremental cost effectiveness ratio (ICER) will have been suitable should cost and effect data for each hospital is available for the time before the implementation of the diagnostic system and a time after the implementation. The use of incremental will allow for the comparison of the outcome of the ICER with the standard threshold figure (if available) or the average willingness-to-pay (WTP) in order to make a sound decision. However the net benefit analysis is also a reliable method of finding out the value for money of an intervention hence its employment to assess the two diagnostic systems under study in this research work.

Health care for all has been an ambition for most nations of the world yet still a challenge for even some largest economies of the world today. Ghana witnessed a wave of many patients reporting late or brought late by their care-givers to many health facilities in the past due to the fact that the health system in those days was the so called "cash-and-carry" simply put a health system were everybody have to pay before receiving health care. This led so many lives been lost and many patients running out of the admission wards of the Ghanaian hospitals. The most pathetic issue of the cruel cash-and-carry system was that pregnant women who had no money to pay for maternal care have to run and leave their newly born babies in some cases shortly after labor and many children were not able to receive health care on time due to their parents or guardians (care-givers) inability to produce the service fees on admission.

This led to a policy break through when the Ghana government decided to implement the National Health Insurance Scheme (NHIS) to replace the cash-and-carry system. This system though young have been able to bring basic health care to the doors of many Ghanaians making it easy for care-givers to take their children to the hospitals on time in times of ill-health.

Though the NHIS covers about 95% of diseases but most health facilities lack the appropriate diagnostic systems in making a precise and profound analysis of samples collected from patients to help make informed diagnosis. This is the case since many infectious diseases are wrongly diagnosed and many "neglected diseases" are not detected on time till they cause major health problem.

Children are mostly affected when it comes to infectious diseases and we know today children and pregnant women are the most affected group when it comes to malaria but the case of other infectious diseases like sepsis has been relegated to the back ground with most physicians lacking the expertise in diagnosing the disease since microbiological diagnostics facilities are lacking in most health facilities in endemic countries.

The findings show that children under one year of age mostly test positive for malaria and an adequate diagnostic system that could help further investigate children in this age group should be procured by the governments of most African countries to build up a reliable and formidable diagnostic system.

With the net benefit value being negative one could tell that the cost far outweighs the benefit that care-givers of children could bear and without the health insurance in place it will be difficult for most care-givers to take their children to the hospital. Hence governments and private institutions as well as donors should do well to provide resources needed to sustain the health insurance systems now in place in Ghana and other African governments should try to implement such health systems as it brings equity and fair distribution of the national cake which fosters social justice as basic health care is a basic human right.

Furthermore the monetary of clinical trials should be taken at heart as that is the only way to find out whether the implemented medical projects are worth implementing. The cooperation between the Bernhard-Nocht-Institute for Tropical Medicine Hamburg, Germany and the Ghana Government which brought about one such great project of establishment a state of the art diagnostic facility in Kumasi, Ghana is a step in the right direction and need much support from institutes and philanthropist from across the globe to carry on with such a great project. This facility is one offers such a sophisticated facility and well trained human resource who could assist in uncovering most of the neglected infectious diseases in African that burdens children and their care-givers alike.

Since the amount of money care-givers were ready to pay for the treatment of their wards was far lesser than the actual cost of treatment for laboratory and drugs alone, health policy makers should consider the average "willingness-to-pay" of the care-givers in the future pricing of health care provision to make health care really affordable for all.

10 Conclusion

Through this research work, one could say that the standard diagnostic system (the normal laboratories) could not have been affordable for the local people without the health insurance scheme. In other words parents or guardians could not have been able to pay out of their pockets for the treatment of their children.

Although some sepsis cases where diagnosed by the physicians through their human experience but one could have a much reliable results if the diagnosis where done with a more sophisticated facility like the microbiological diagnostics system at the Kumasi Center for Collaborative Research in Tropical Medicine (KCCR) in Kumasi, Ghana.

In actual fact, the amounts of money care-givers were ready to offer for their children's treatment would not have reach the real cost of treatment.

In the future, the authorities of the two hospitals should try to introduce a health economic data inventory where cost data as well as length of stay in a hospital's ward for individual diseases are recorded. The recording of the outcome of the stay for each patient or each disease could help to easily evaluate the cost and benefit of an intervention since the life expectancy for each disease could be made available.

11 Reference

Agogo Presbyterian Hospital. (2010a). Agogo Presbyterian Hospital Profile | Agogo Presbyterian Hospital. *Agogo Presbyterian Hospital Profile*. Retrieved October 25, 2011, a from http://www.agogopresbyhospital.org/?q=node/5

Agogo Presbyterian Hospital. (2010b). Agogo Presbyterian Hospital Profile, Staff Strength. *Agogo Presbyterian Hospital Profile | Agogo Presbyterian Hospital*. Retrieved November 1, 2011, b from http://www.agogopresbyhospital.org/?q=node/5

Asante Akim North Municipal Assembly. (2006). Ghana » Ashanti Region » Asante Akim North District. *About the district*. Retrieved October 25, 2011, from http://www.asanteakimnorth.ghanadistricts.gov.gh/

BNITM Hamburg. (n.d.). Neglected infections as causes of morbidity and mortality in African children under five years of age - establishment of an advanced diagnostic system. *Bernhard-Nocht-Institut für Tropenmedizin - Hamburg*. Retrieved October 24, 2011, from http://www.bni-hamburg.de/

Bosomtwe District Assembly. (2006). Ghana » Ashanti Region » Bosomtwe/ Atwima/ Kwanhuma. Retrieved October 25, 2011, from http://bosomtwe.ghanadistricts.gov.gh/

Ghana Districts. (2006a). Ghana Districts - A repository of all districts in the republic of Ghana. Retrieved October 25, 2011, a from http://www.ghanadistricts.com/districts/?r=2&_=20&sa=5514

Ghana Districts. (2006b). Ashanti - Bosomtwe: Climate and vegatation. Retrieved October 26, 2011, b from http://www.ghanadistricts.com/districts/?r=2&_=20&rlv=climate

Ghana Districts. (2006c). Ashanti - Bosomtwe: Health facilities in the district. Retrieved October 26, 2011, c from http://www.ghanadistricts.com/districts/?r=2&_=20&sa=979

Ghana Districts. (2006d). Ghana Districts - A repository of all districts in the republic of Ghana. Asante Akim North Municipal. Climate and vegetation. *Asante Akim North Municipal. Climate and vegetation*. Retrieved November 15, 2011, d from http://www.ghanadistricts.com/districts/?r=2&_=18&rlv=climate

Ghana Districts. (2006e). Ashanti - Asante Akim North Municipal, Health Sector. *Ashanti - Asante Akim North Municipal, Health Sector*. Retrieved November 1, 2011, e from http://www.ghanadistricts.com/districts/?r=2&_=18&sa=935

Ghana Health Insurance Authority. (n.d.). The road to Ghana’s health care financing. *The road to Ghana’s health care financing*. Retrieved November 14, 2011, from http://www.nhis.gov.gh/?CategoryID=158&ArticleID=1110

Global Health Council. (2000, 2011). Global Health Council | The Impact of Infectious Diseases. *Global Health Council. The impact of infectious diseases*. Retrieved October 24, 2011, from http://globalhealth.org/infectious_diseases/

Gray, A. (2011). *Applied methods of cost-effectiveness analysis in health care*. Oxford: Oxford University Press.

InterCare. (2010). St Michaels Hospital, Pramso | Inter Care – Medical Aid for Africa. *InterCare - Medical Aid for Africa*. Retrieved October 26, 2011, from http://www.intercare.org.uk/health-centre/ghana/st-michaels-hospital-pramso

Kerzner, H. (2009). *Project management : a systems approach to planning, scheduling, and controlling* (10th ed.). Hoboken N.J.: John Wiley & Sons.

Mathers, C. D., Ezzati, M., & Lopez, A. D. (2007). Measuring the Burden of Neglected Tropical Diseases: The Global Burden of Disease Framework. (S. Brooker, Ed.)*PLoS Neglected Tropical Diseases*, *1*, e114. doi:10.1371/journal.pntd.0000114

Mayor, S. (2008). Research organisations join forces to develop treatments for neglected infectious diseases. *BMJ*, *336*, 1396-1397. doi:10.1136/bmj.a389

Molyneux, D. H. (2004). “Neglected” diseases but unrecognised successes—challenges and opportunities for infectious disease control. *The Lancet*, *364*, 380-383. doi:10.1016/S0140-6736(04)16728-7

Moran, M., Guzman, J., Ropars, A.-L., McDonald, A., Jameson, N., Omune, B., Ryan, S., et al. (2009). Neglected Disease Research and Development: How Much Are We Really Spending? *PLoS Medicine*, *6*, e30. doi:10.1371/journal.pmed.1000030

NHIA. (n.d.). NHIS Benefits Package. *NHIS Benefits Package*. Retrieved November 15, 2011, from http://www.nhis.gov.gh/?CategoryID=158&ArticleID=120

WebMD. (2005, 2011). Sepsis or Septicemia (Blood Infection) Symptoms, Causes, Treatments. Retrieved November 17, 2011, from http://www.webmd.com/a-to-z-guides/sepsis-septicemia-blood-infection

Yazdizadeh, B., Majdzadeh, R., & Salmasian, H. (2010). Systematic review of methods for evaluating healthcare research economic impact. *Health Research Policy and Systems*, *8*, 6. doi:10.1186/1478-4505-8-6

Bosomtwe District. (2006). Ghana » Ashanti Region » Bosomtwe/ Atwima/ Kwanhuma. Retrieved January 31, 2012, from http://bosomtwe.ghanadistricts.gov.gh/?arrow=atd&_=20&sa=4550

Department Of State. The Office of Electronic Information, B. of P. A. (2011, December 21). Ghana. Retrieved January 30, 2012, from http://www.state.gov/r/pa/ei/bgn/2860.htm

Ghana Government. (2012). Ghana at a Glance. Retrieved January 30, 2012, from http://www.ghana.gov.gh/index.php/about-ghana/ghana-at-a-glance

NHIS. (n.d.). The Benefits of the National Health Insurance Scheme. Retrieved January 31, 2012, from http://www.nhis.gov.gh/?CategoryID=216#ans20

WHO. (2011). to overcome the global impact of neglected tropical diseases. Weekly epidemiological record, No. 13, 18, pp. 113-128. Retrieved on 15.09.2011 from <http://www.who.int/wer/2011/wer8613.pdf>

Derbie, Simon S. (n.d.). MOTEC Report on St. Michaels Hospital Pramso. Retrieved on 25th October, 2011 from http://www.google.de/#hl=de&sa=X&ei=6WymTovpCtDrsgat1t39DQ&sqi=2&ved=0CBgQBSgA&q=Simon%27s+Derbie.+MOTEC+Trustee+Facilitator+St.&spell=1&bav=on.2,or.r_gc.r_pw.,cf.osb&fp=91f06d13ba08caee&biw=1280&bih=651>

OANDA. (1996-2012). Währungsrechner, OANDA. Retrieved January 30, 2012 from http://www.oanda.com/land/de/currency/converter/

Boakye, William. (n.d.). Bosomtwe District Report on Malaria. District Health Information Office. A Powerpoint Presentation from the District Health Information Officer. Received in April 2011.

Asante Akem North Municipal. (2006). Ghana » Ashanti Region » Asante Akim North District. Retrieved January 31, 2012, from http://asanteakimnorth.ghanadistricts.gov.gh/?arrow=atd&_=18&sa=5963

12 Author's Declaration

I declare that the work recorded in this thesis is entirely my own, except where otherwise stated, and that it is also of my own composition.

I further declare that no part of this work has been submitted as part of any other degree.

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