CONTROL OF PREGNANCY-ASSOCIATED MALARIA THROUGH COMMUNITY INVOLVEMENT IN RURAL GHANA

By

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DECLARATION

I hereby declare that this submission is my own work towards the Doctor of Philosophy (Ph.D) and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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Chapter 1

Introduction and Literature Review

Chapter 1: Introduction and Literature review

Introduction

Background

Malaria affects between 189 – 327 million people and 86% (152 – 287 million) of the cases reported are in Africa (WHO, 2008). Pregnant women and children under five years are the high risk groups for malaria. Pregnancy renders a woman more susceptible to malaria infection and associated morbidity. This effect is more pronounced in the first pregnancy and tends to decrease with increase in parity. Malaria in pregnancy can result in anaemia, miscarriage, premature delivery, intra uterine growth retardation, low birthweight (LBW) or stillbirth (Guyatt and Snow, 2004). However, in endemic areas with stable perennial transmission the adverse consequences reflect mainly in malaria-associated maternal anaemia and lowbirthweight (LBW) (Steketee *et al.,* 2001; Guyatt and Snow, 2004; Savage *et al*., 2007). Mutabingwa (1994) and Shulman *et al*. (2001) demonstrated a high incidence of anaemia in pregnancy especially in primigravidae in malaria endemic areas, protection against which resulted in increased haemoglobin levels. Steketee *et al.* (2001) attributed 3-15% of anaemia in pregnancy to malaria. LBW is the single greatest risk factor for perinatal mortality (McGregor *et al.,* 1983; Chimsuku *et al.,* 1994; Shulman *et al.,* 2001). Also, 40% of LBW has been attributed to malaria by Brabin and Piper (1997). Placental parasitaemia has been reported as a major contributor to LBW and premature deliveries and is more frequent in primigravidae than women of higher parities (McGregor *et al.,* 1983). Hence, the effect of parity and the peak periods for parasitaemia and anaemia have important implications for the timing of interventions and targeting priority groups in resource poor areas if interventions should yield maximum results.

Three major preventive measures being implemented by governments in malaria endemic countries to reduce the burden in pregnancy and its consequent adverse effects on birth outcome are chemoprophylaxis, IPTp and use of ITNs. Binka *et al.* (1997) reported reduced morbidity in children who used ITNs in Northern Ghana and in Western Kenya, Ter Kuile e*t al.* (1999) reported reduced maternal malaria and anaemia as a result of using ITNs. Chloroquine has been the main antimalarial drug for prophylaxis for decades until widespread resistance was reported which reduced its utility (Koram *et al*., 2005). Due to this and the heavy burden of malaria in Sub-Saharan Africa, the World Health Organization recommended the use of IPTp with suitable antimalarials. IPTp with sulphadoxine-pyrimethamine (SP) is effective against adverse pregnancy outcomes (Shulman *et al.,* 1999; Rogerson *et al.,* 2000; Njagi, 2002) and is being implemented by many malaria endemic countries in Africa (WHO, 2008). The implementation of IPTp however faces challenges where there is sub-optimal antenatal clinic (ANC) attendance, late first ANC visit and irregular supply of drugs (van Eijk *et al.,* 2004). The delivery of the IPTp package at only ANC clinics makes it non-accessible to many pregnant women especially in rural areas and low-income communities due to inaccessibility of the health facility and unaffordable service and transport cost (Ndyomugyenyi, 1999). However, if community agents who already offer some health services could be trained to properly administer antimalarials, it might improve access, coverage and compliance. Village health workers (VHWs) are common in many poor rural communities in Africa. These VHWs include Community-based surveillance volunteers (CBSVs), Community medicine distributors (CMDs) and traditional birth attendants (TBAs), who are the most accessible of all providers of delivery services (Greenwood *et al.,* 1989). Their role of providing maternity services in rural communities makes them strategically placed to play an important role in controlling malaria in pregnancy.

In Ghana, about 44.1% of all outpatients' department (OPD) cases are presumptively diagnosed and treated as malaria (MOH, 2000; GHS, 2007). Out of all OPD cases reported by pregnant women at health institutions, malaria accounts for 13.1% and malaria is responsible for 9% of deaths among the pregnant population (MOH/GHS 2008). Ghana reviewed its antimalarial policy after high levels of chloroquine failure was reported (Koram *et al.*, 2005). The National Malaria Control Programme (NMCP) in Ghana started implementation of IPTp with SP on a pilot base in twenty districts in 2004 and rolled out to all regions and districts in the country in 2005. In Ghana, the IPTp guidelines require that a single dose of SP (sulphadoxine 500mg plus pyrimethamine 25mg) be administered to pregnant women three times during routine ANC visits as a directly observed therapy (DOT). The first dose should be given in the second trimester after quickening (between 16 and 24 weeks) and the second and third doses should be given at intervals of at least one month apart after the first dose and not after 36 weeks gestation. This is delivered as part of a comprehensive antenatal package including ITNs and haematinics (GHS/NMCP/JHPIEGO, 2005). The DOT strategy of delivering a single-dose treatment of SP as IPTp makes its implementation simple and easy. The service is however only delivered at ANC clinics, making it unavailable to many women in difficult to reach rural areas due to poor road infrastructure, inadequate health care resources and transport cost. As the gap between urban and rural health care infrastructure and socioeconomic circumstances increase, malaria control remains one of the biggest challenges to the health sector. The Afigya Sekyere district in the Ashanti region of Ghana has a large rural population with a limited number of health facilities and poor road networks which hinders access especially during the rainy season (DPU, 2005; DHA, 2005). Malaria transmission in the district is intense and perennial, accounts for over 60% of all OPD cases and is the primary cause of hospital admissions (DHA, 2002; 2005; 2007). The prevalence of malaria parasitaemia in pregnancy has however not been assessed, and the problem of late first ANC visit (DHA, 2004; 2005) poses a major challenge to compliance with the three doses of IPTp schedule (DHA, 2004; 2005).

This study was designed to explore the full potential of recognized community health agents such as community-based surveillance volunteers (CBSVs) and TBAs in making malaria control more accessible to pregnant women who live in remote and inaccessible communities. The potential of community health agents in effectively increasing access to prompt and appropriate treatment of malaria in children has been demonstrated through the Home-based management of malaria (HBMM) strategy (Gyapong and Garshong, 2007; Ajayi *et al.*, 2008). The strategy involved making available appropriate and highly effective antimalarials through Community Medicine Distributors (CMDs), with communication strategies targeted at behavioural change. The supportive component of the HBMM strategy included training programmes, supply management, supervision, monitoring and evaluation, management information systems, and capacity building. Adapting this strategy in the implementation of IPTp would increase access to the intervention and improve compliance. As women in less accessible communities become well informed about IPTp through appropriate communication strategies, there is the potential benefit of increasing access to HBMM, thereby improving child survival.

Justification

Malaria is of public health importance in all endemic areas hence African leaders in 2000 declared their political will to control it. One of the Roll Back Malaria (RBM) targets set by the leaders in Abuja in 2000 was that by 2005, at least 60% of all pregnant women who are at risk of malaria, especially those in their first pregnancies, have access to chemoprophylaxis or IPTp (WHO, 2000b). The IPTp package for pregnant women is delivered only at health facilities in Ghana making the service inaccessible to many pregnant women in remote and inaccessible areas. Secondly though the average number of ANC visit is four in Ghana, there is a common problem of late first ANC visits (in the second trimester and third trimester) and irregular visits which reduces adherence to the recommended three doses. A facility-based intervention alone is not sufficient to have a significant or sustained impact on malaria control in pregnancy. Alternative strategies are therefore needed for the delivery of malaria interventions to pregnant women in deprived rural areas in Ghana. Trained and recognized community health workers (CHWs) such as CBSVs and TBAs are found in all rural communities and community members have easy access to them. It was envisaged that the CHWs can identify pregnant women early, educate them on IPTp with SP for them to access the service. The early identification will increase overall access, improve compliance with the recommended three doses of SP and thus potentially lead to a reduction in the prevalence of malaria parasitaemia and anaemia and increase birthweight.

Objectives

General Objective

To evaluate a complementary strategy of community involvement in the control of pregnancy-associated malaria and anaemia in an area of intense malaria transmission in Ghana.

Specific Objectives

The specific objectives of the study were to:

- Explore local perceptions of malaria in pregnancy and health-care practices of control of malaria in pregnancy and determine factors influencing utilization of antenatal services.
- Describe birth weight distribution in the Afigya Sekyere district and determine factors influencing it.
- Determine the prevalence of malaria parasitaemia and anaemia in pregnancy in the Afigya Sekyere district
- Determine the effect of IPTp on pregnancy outcome in primigravidae and secundigravidae and evaluate the effectiveness of a community-based malaria intervention strategy on prevalence of malaria parasitaemia and anaemia in pregnant women
- Assess coverage, compliance and health providers' perceptions of implementation of IPTp with SP

Literature review

Malaria epidemiology

About half of the world's population (3.3 billion) is at risk of malaria, especially those living in sub tropic and tropical poor countries (WHO, 2008). The disease is endemic in about 109 countries (WHO, 2008) (Fig. 1.1) and leads to about one million deaths annually of which about 91% takes place in Africa (WHO, 2008). Factors responsible for the high morbidity and mortality in endemic areas in Africa include presence of highly efficient vectors, a large rural population, suitable climatic conditions, unfavorable socio-economic conditions, human behavior and an inadequate health care infrastructure (Warrell and Gilles, 2002). In Africa, 20% of all childhood deaths are due to malaria and it is estimated that an African child experience between 1.6 and 5.4 episodes of malaria each year (WHO, 2005). Though it is difficult to quantify the exact burden of malaria in Africa, reports indicate that the disease is responsible for 50% of out-patient department (OPD) cases and 20% of admissions. Malaria poses a risk to survival and both morbidity and mortality place a burden on households, the health service and economic development of communities and nations. Malaria is estimated to be responsible for an annual loss of about 0.5% to 1% of the gross domestic product (GDP) in endemic countries, 1.3% reduction in economic growth rate and many families spend a substantial amount of their income on malaria treatment (WHO, 2005; 2006a).

Centuries back, malaria was named based on the miasma theory as it was believed to be due to 'bad air' until in 1880 when Laveran discovered the malaria parasite (Bruce-Chwatt, 1988). The five parasite species affecting humans are *Plasmodium falciparum, P. malariae, P. ovale, P. vivax* and *P. knowlesi* and the predominant specie (over 80%) in endemic areas is *P. falciparum* (Walker–Abbey *et al.*, 2005; Cox-Singh and Singh; WHO, 2008). The human species are transmitted through the infective bites of the female anopheles mosquitoes (vector). Malaria transmission requires the interaction of four epidemiologic factors, namely the parasite, human host, vectors, and the physical, biological and socioeconomic environment (Heggenhougen *et al.,* 2003). The distribution of the disease is largely influenced by climatic and environmental factors such as temperature, rainfall, humidity, presence of water, vegetation that promotes habitat and breeding sites of the vectors and man to vector contact (Warrell and Gilles, 2002). Development of the vector and parasite is temperature dependent. The extrinsic incubation period (development in the vector) of the parasite requires humidity and favourable temperatures between 25°C and 30°C. This stage of development ceases below 16°C and slows down when temperatures are above 35°C. The female *Anopheles gambiae* has been observed to breed more prolifically in temporary and turbid water while *A. funestus* is known to breed in permanent water bodies. Agricultural practices influencing human settlements and land use, household factors promoting human-vector contact such as lack of ceilings, population density and presence of animals close to the house contribute to increased infection risk (Warrell and Gilles, 2002).

Malaria morbidity

The range of clinical manifestations of malaria include asymptomatic parasitaemia, acute clinical malaria with fever, headache, general malaise and severe complicated malaria with hyperthermia, cerebral malaria, hypoglycaemia and multiple organ failures. Chronic malaria may lead to anaemia especially affecting young children and pregnant women. Pregnancy-associated malaria may further lead to reduced birth weight and increased infant mortality. In areas with relatively stable perennial transmission, the prevalence of parasitaemia is high and some level of immunity is acquired over time hence a lot of cases are asymptomatic (Warrell and Gilles, 2002). Those with the least immunity experience the most severe disease (Breman, 2001; Warrell and Gilles, 2002). Children with severe malaria will have altered consciousness, convulsions, hypoglycaemia, anaemia and acidosis whiles features of severe malaria in adults include renal failure, adult respiratory distress syndrome and jaundice (Breman, 2001).

Fig. 1.1. Estimated incidence of malaria per 1000 populations, 2006 (Source: WHO, 2008)

Malaria in pregnancy

Approximately 50 million women in malaria endemic countries become pregnant annually and about 10000 of them and 200000 of their infants die as a result of malaria infection (WHO, 2005). Pregnancy renders a woman more susceptible to malaria hence the prevalence of parasitaemia is higher in pregnant women than non-pregnant women.

Brabin (1983) reported that primigravidae are more susceptible to malaria than multigravidae. Also, Brabin and Rogerson (2001) have reported that primigravidae are more susceptible to malaria compared to nulligravidae and this has been attributed to infection-specific immunological and endocrinological factors. In maternal malaria, peripheral parasitaemia may be low or absent but parasites sequestrate in the placenta. *P. falciparum* is known to sequestrate in the placenta and these parasites bind to chondroitin sulphate A (CSA), which is expressed on the surface of the syncytiotrophoblast (Fried 2001; Rogerson *et al*., 2007a; Rogerson *et al*., 2007b; Guitard *et. al*., 2008). In the non-pregnant state however, CSA is not accessible for parasite adhesion hence women are not exposed to the CSA-binding parasites until the first pregnancy, which makes the primigravidae naïve to the infection. With repeated pregnancies, women develop specific anti-adhesion antibodies that block parasite adhesion to the CSA, which accounts for the multigravidae being less susceptible and seen as having lower parasite rates and lower parasite densities compared to primigravidae (Fried 2001; Guitard *et al*., 2008). Nnaji *et al*. (2006) in Nigeria reported parasitaemia prevalence of 87.9% in primigravidae, 81.4% in secundigraviade and a further reduction at higher parities.

The prevalence of pregnancy-associated malaria, clinical manifestations and complications vary between high transmission and low transmission areas due to differences in immunity of the pregnant women in the two areas (WHO, 2000c). The manifestations also depend on the stage of pregnancy, previous history of malaria exposure and general maternal health and nutrition status (Brabin and Rogerson, 2001). Several studies have reported varied degrees of prevalence of the disease in pregnancy (Singh, 1999; Newman *et al.,* 2003a; Geertruyden *et al.,* 2005; Coulibaly *et al*., 2007;

Kayentao *et al.,* 2007). In unstable transmission areas, as low as 1.8% parasitaemia prevalence in pregnancy has been reported whiles in stable transmission areas, about 32.2% parasitaemia prevalence in pregnancy has been reported (WHO, 2000c). In low transmission areas, women have little immunity against malaria infection hence they suffer severe disease and the consequences include miscarriages, stillbirth and high infant mortality. In high transmission (endemic) areas, however, though people develop some level of immunity, the disease is a common occurrence in pregnancy (WHO, 2000c). Asymptomatic parasitaemia is common and a pregnant woman is more susceptible to placenta parasitaemia and adverse effects such as anaemia and low birthweight babies (WHO, 2000c; Cot and Deloron, 2003). The prevalence of malaria parasitaemia differs depending on whether the population is urban or rural, effective chemoprophylaxis is used and if co-infection with the human immunodeficiency virus (HIV) is common because HIV infection impairs immunity and could lead to increased susceptibility of pregnant women to malaria (McGregor *et al*., 1983; Steketee *et al*., 1996; Verhoeff *et al*., 1999a, Mutabingwa *et al*., 2001, van Eijk *et al*., 2003; WHO, 2004; Keen *et al*., 2007).

Though pregnant women have increased risk of malaria infection, the level of risk varies with gestational age. Peak parasitaemia prevalence has been reported in early or mid-pregnancy and a return to non-pregnant prevalence levels at delivery or close to delivery has been observed (Brabin, 1983). This change in prevalence at various stages of pregnancy has been explained by an early decrease and subsequent increase in the recovery rate from infection (Brabin and Rogerson, 2001). In contrast, a study conducted in Uganda demonstrated high prevalence of *P. falciparum* in pregnant women at delivery (Kasumba *et al.,* 2000). Brabin (1983) reported peak periods of falciparum parasitaemia especially in primigravidae between 9-16 weeks gestation in Kenya and Papua New Guinea. Hence, any antimalarial intervention in pregnancy should be started early to maximise the benefits of the intervention. Maternal age has also been noted as a risk factor for the infection and its severity, with younger age women at greater risk (Rogerson *et al.,* 2000; Tako *et al.,* 2005; Kayentao, 2007). Wort *et al.* (2006) in a study in the Morogoro region in Tanzania, a holoendemic malaria transmission area with seasonal peaks reported higher prevalence of parasitaemia in adolescent primigravidae than adult primigravidae and observed that prevalence of parasitemia decreased with increasing age in adolescent primigravidae. They argued that the parity-specific antimalarial immunity that usually develops following first pregnancies is possibly less marked during adolescence, since adolescent secundigravidae had parasite prevalence comparable to adult primigravidae. Shulman *et al.* (2001) also reported that placenta parasiatemia was more common among younger women and they reported 76% prevalence in primigravidae younger than 20 years compared with 50% in primigravidae aged 20 years or older.

Malaria-related anaemia in pregnancy

Malaria is associated with a high prevalence of anaemia in pregnancy though the mechanism is not fully understood. Other causes of anaemia in pregnancy include iron and folate deficiencies, haemoglobinopathies, and other parasitic infections such as hookworms (Fleming, 1989; Bouvier *et al.*, 1997; Shulman *et al.*, 1999; Verhoeff *et al.*, 1999b; Mockenhaupt *et al.*, 2000; Stoltzfus, 2001; Cot and Deloron, 2003; Achidi *et al.*, 2005). Malaria-related anaemia involves two mechanisms; the destruction of red blood cells (RBCs) and the decreased production of RBCs. The relative contributions of each of these mechanisms differs according to age, pregnancy state, antimalarial immune status, genetic constitution of infected individuals and the endemicity of malaria (Menendez *et al.,* 2000). Kagu *et al*. (2007) reported a prevalence of anaemia of 72% in women attending ANC in a tertiary hospital in Northeastern Nigeria. They reported malaria parasitaemia (*P. falciparum*) in 22.1% of their study participants and all the parasitaemic women were anaemic. The incidence is higher in primigravidae in endemic areas (Mutabingwa, 1994; Ndyomugyenyi & Magnussen, 1999; Shulman *et al*., 1999, 2001). In contrast, Kagu *et al*. (2007) reported a higher prevalence among multipara (73.1%) and grandmultipara (71.4%) than among primigravidae (70.5%). These differences may be partly attributed to excess iron loss in women of higher parity due to repeated pregnancies. Brabin and Rogerson (2001) observed that in high malaria transmission areas, primigravidae have a 1.5 higher relative risk for severe anaemia compared with higher parities. The relationship between malaria and anaemia has been studied and the prevalence of anaemia found to parallel seasonal changes in parasite prevalence (Bouvier *et al*., 1997; Verhoeff *et al*., 1999b). Steketee *et al.* (2001) attributed 3-15% of anaemia in pregnancy to malaria. Anaemia has serious adverse effects on pregnancy outcomes. Severe anaemia impairs transfer of nutrients between mother and foetus, leading to intrauterine growth retardation (Brabin *et al*., 1990). Mola *et al.* (1999) reported high rates of stillbirth in women with severe anaemia from a health facility-based data in Papua New Guinea. Malaria can result in maternal death through severe anaemia leading to profound hypoxia and congestive cardiac failure (Menendez *et al*., 2000).

Malaria and low birthweight

Birthweight is an important predictor of infant growth, morbidity, and survival of the newborn (WHO, 1981) and is influenced by many factors. The most important of these factors are gestational age and foetal growth rate (Bantje, 1983; Kramer, 1987; Matsuda, 1990). Low birthweight (LBW) is the single greatest risk factor for perinatal mortality (WHO, 2000c). It is also an important risk factor for neonatal and infant mortality (McCormick, 1985). Infants with very LBW (<1500g) are even at a greater risk and Moro *et al.* (2007) reported a mortality of 17.3% for infants with very LBW. There are multiple factors influencing LBW and these include genetics, multiple pregnancies, placental abnormalities, maternal nutrition, maternal age, gravidity, history of smoking, viral, bacterial, and parasitic infections (Guyatt and Snow, 2004). Malaria contributes significantly to LBW through preterm delivery and intra-uterine growth retardation (IUGR). It is reported that between 167,000 to 967,000 malaria-related LBW babies are born annually (Murphy and Breman, 2001) and Brabin and Piper (1997), attributed 40% of LBW to malaria. LBW and premature deliveries have been observed to be more frequent in primigravidae than in women of higher parities and a major contributor was placenta parasitaemia (McGregor *et al.,* 1983; Shulman *et al.,* 2001, Dorman *et al.*, 2002). Kayentao *et al.* (2007) reported high prevalence (17- 42.3%) of placental malaria which was associated with low gravidity. Shulman *et al.* (2001) also investigated the association between placental malaria and LBW in an area of moderate malaria transmission in Kenya and observed a significant interaction between chronic or past placenta infection, severe anaemia and LBW and they reported that the risk of LBW was very high in women with both chronic or past placental malaria and severe anaemia. Similarly, Mockenhaupt *et al.* (2006) also found in a highly endemic setting in Ghana that placental parasitaemia was associated with LBW with an adjusted odds ratio of 1.5.

The delivery of LBW babies is also related to maternal age. Wort *et al.* (2006) reported from a study in Tanzania that adolescents had twice the proportion of LBW that was found in adult primigravidae.

Control strategies for malaria in pregnancy

Various efforts have been made to control malaria for centuries. Earlier efforts included use of extract of the Chinese *qinghaosu* plant *(artemisia annua)* and the bark of the Peruvian Cinchona tree (fever tree) for treatment as well as use of hand-woven bednets for protection against mosquitoes (Heggenhougen *et al.,* 2003). Chloroquine has been used in many countries for many decades as the first line of treatment and for chemoprophylaxis in pregnancy. It was safe, cheap and easy to use. However, parasite resistance has reduced its utility for prophylaxis and case management in most malaria endemic areas (Bloland & Ettling, 1999). Currently the strategies for control of malaria in pregnancy being used in most areas of stable malaria transmission in Africa is the WHO recommended package of IPTp, ITNs and effective management of clinical malaria and anaemia (WHO, 2004). The IPTp strategy has been adopted by all 35 endemic African countries where it is suitable, with 25 of them implementing it and 18 scaling it up to make it accessible at all health facilities (WHO, 2006a). Several studies have reported on the efficacy of ITNs on malaria morbidity, anaemia and LBW in the general population, children and pregnant women (Binka *et al.,* 1997; Ter Kuile e*t al.,* 1999; Browne *et al.,* 2001; Njagi, 2002; Njagi *et al.,* 2003). Ter Kuile e*t al.* (1999) reported reduced maternal malaria and anaemia as a result of using ITNs. Njagi *et al.* (2003) from a study in a highly malarious area in Kenya reported a protective efficacy of 41.6% from anaemia in primigravidae who used ITNs. In contrast, Browne *et al.* (2001)

found no significant difference in pregnancy outcome for women who used ITNs compared to those who did not use it in a study in Ghana. The authors also reported low use of free bednets among study women, which may partly account for the observed outcome.

The choice of SP for IPTp is because SP is efficacious, safe in pregnancy and is easy to dispense (Newman *et al*., 2003b). The WHO recommends two doses of SP to be given, once in the second trimester and once in the third trimester at least one month apart. In addition, WHO also recommends an optimal schedule of four ANC visits, with three visits occurring after quickening (WHO, 2000a). IPTp with SP has been delivered with good effect on pregnancy outcomes (Rogerson *et al.,* 2000; Njagi, 2002; van Eijk *et al.,* 2007). A number of intervention studies have focused on pregnancies of lower gravidae because malaria is parity related. Shulman *et al.* (1999) studied the effect of IPTp in primigravidae on parasitaemia and anaemia and reported the effectiveness of the intervention with an 85% protective efficacy. Similarly Challis *et al*. (2004) reported from a study in Mozambique that two doses of SP reduced malaria parasitaemia from 30.6% at ANC booking to 6.3% at delivery and placenta parasiatemia of 2.4% was observed in the intervention group compared to 13.3% in the placebo group. Van Eijk *et al*. (2007) found no additional haematological benefit of SP over haematinics though IPTp was associated with halving of malaria cases. Similarly, Mbaye *et al*. (2006) in assessing the effect of IPT-SP on anaemia and LBW in multigravidae in Malawi observed no difference in anaemia and birthweight of women who used IPT and ITNs, suggesting a greater benefit of IPT to women of lower gravidity. Brabin and Rogerson (2001) reviewed several studies that assessed prevalence of malaria in relation to parity and found that with parasite prevalence of 10% or below, multigravidae and primigravidae have almost the same prevalence hence selective control strategies targeting primigravidae will be inappropriate in areas with prevalence below 10%. However, since women of lower gravidity have greater benefit of IPT compared to multigravidae, in resource poor environments with higher prevalence, it will be prudent to concentrate resources on reaching those at the greatest risk such as the primigravidae and secundigravidae. The WHO IPTp policy limits the delivery of the service as a component of antenatal care, making it non-accessible to many pregnant women in rural and remote areas where health facilities are limited. Innovative strategies targeting high risk groups in such deprived areas for IPTp will contribute to malaria control in pregnancy.

The choice of interventions and their uptake depends on several factors. These include the efficacy of the intervention, consumer acceptability and compliance, provider acceptability, cost, safety, integration with other interventions, the local system of health-care delivery, and the degree of combination of these factors (Robb, 1999). Holtz *et al.* (2004) observed in a study in Malawi that only 36.8% of the women studied received the recommended two-dose regimen of SP/IPT and multigravidae were less likely to receive the recommended SP/IPT doses. Some studies aimed at identifying factors contributing to the low uptake of IPTp reported late first ANC visit, irregular ANC attendance, cultural belief and the consumers' perceptions on the severity of malaria in pregnancy, the efficacy of SP and staff attitude (van Eijk *et al.*, 2004; Mbonye *et al.*, 2007; Launiala & Honkasalo, 2007; Gikandi *et al.*, 2008). An understanding of the health care provider's perceptions on IPTp, its uptake and compliance will be necessary if IPTp should have a sustained impact on malaria morbidity. Malaria control today faces great challenges because of drug resistance (Bloland and Ettling, 1999). Bloland

and Ettling (1999) suggested that intensity of transmission, drug pressure, and number of mutations in the parasite genes are some of the factors that are responsible for resistance development. Surveillance of the use and efficacy of SP for IPTp would ensure regular assessment of its benefits for control of malaria in pregnancy and permit early detection of resistance.

Role of community agents in disease control

Disease surveillance is an important aspect of many national disease control programmes. This role in rural and smaller communities is usually played by community agents that are identified, recognized and accepted by community members and health persons. Their ability to accurately report disease and appropriately administer preventive or treatment measures is a key factor in disease control. Several studies have tested the abilities of community health workers to contribute to disease control (WHO, 2006b; 2008, Gyapong and Garshong, 2007). Similar to other disease control programmes CHWs have also been successfully used in malaria control programmes (Greenwood *et al.*, 1989; Delacollette *et al.*, 1996; Kidane and Morrow, 2000; Gyapong and Garshong, 2007). Kidane and Morrow (2000) explored the advantage of closeness to the community and developed a malaria worker network of mother co-coordinators who provided antimalarials and gave health education to households. Delacollette *et al.* (1996) also recruited, trained and used CHWs for malaria treatment and reported appreciable levels of reduced malaria morbidity and changes in health care behavior. CHWs have also been used in pregnancy-related health issues. Greenwood *et al.* (1989) and Mbonye *et al.* (2008) used traditional birth attendants and other CHWs in the administration of malaria chemoprophylaxis and IPT. Their findings indicated a positive effect on pregnancy outcome. Mbonye *et al.* (2008) also reported high compliance from the community-based IPTp.

Malaria parasite prevalence peaks in early and mid-pregnancy (Brabin, 1983) but generally in Africa, only 10% of women attend ANC during the first trimester (Brabin and Rogerson, 2001). Community agents could be used to identify women early for appropriate intervention. In many instances also women have attended ANC without receiving antimalarials (Holtz *et al.,* 2004). If community agents who offer some health services could be trained to properly administer antimalarials, it may improve coverage and impact morbidity. Hill and Kazembe (2006) observed after reviewing several studies on IPT that whilst countries in sub-Saharan Africa have made important progress with IPT implementation, coverage levels remain low and that high ANC attendance alone is not sufficient to ensure high IPT coverage. Their review observed staff shortages, poor drug supply, poor ANC access and poor health worker practices as some of the operational challenges in delivering IPT. Engaging the services of recognized CHWs in deprived and inaccessible areas for community sensitization, educating pregnant women, recruiting them early for IPT and delivering IPT would have a sustained impact on malaria control.

Malaria situation in Ghana

Malaria is endemic in all the regions of Ghana and accounts for 44.1% of outpatient cases. The disease is responsible for 13.1% of all cases of deaths and over 22% of deaths in children under five years (MOH, 2002; MOH/GHS, 2008). The direct cost of a single episode of the disease to a household in Ghana is estimated at US$ 6.87 (WHO, 2006a). The transmission levels follow ecological zones of Ghana, with highest incidence of malaria cases in the forest zone, followed by the coastal zone and then the northern savanna zone having the lowest and seasonal transmission level (Afari *et al.,* 1992; Browne *et al.,* 2000). Koram *et al.* (2003) in a survey in Northern Ghana found parasitaemia level of 22% during dry-low transmission season and 61% in the wet-high transmission period. *P. falciparum* has been reported as the main malaria parasite species (Browne *et al.,* 2000). A prevalence of 35.1% has been reported in women attending ANC (Glover-Amengor *et al., 2005).* Anaemia in pregnancy is an important problem in Ghana and malaria is a major contributor to this (Mockenhaupt *et al.*, 2000; Glover-Amengor *et al.*, 2005). Glover-Amengor *et al.* (2005) reported a prevalence of 57.1% in the Sekyere West district of the Ashanti region, with 64% prevalence in rural communities compared to 47.9% in urban communities. Current malaria control strategies include promotion and use of ITNs, chemotherapy using artemisinin-based combination therapy (ACT) and SP for IPTp, effective case management, in-door residual spraying in some selected districts and health promotion. Several studies have reported on distribution and use of ITNs in Ghana using various strategies (Binka *et al.*, 1997; Browne *et al.,* 2001; NetMark, 2005; Grabowsky *et al.,* 2007). All these studies reported increases in coverage with nets but there are still challenges with the proper use of ITNs both for children and pregnant women. High ANC attendance has been reported in Ghana but with low use of malaria preventive measures especially ITNs by pregnant women even in situations where bednets were free (MOH, 2002; Browne *et al.*, 2001). The use of any form of mosquito nets has been reported to be between 11-20% in Ghana (WHO, 2005). IPTp with SP is currently being delivered in all public health facilities in Ghana as a component of the ANC package. Available figures indicate that the proportion of pregnant women who accessed one dose of IPT with SP was 64.3% and compliance rate was 31.4% in 2007 despite high ANC coverage (NMCP, GHS Review, 2008). There is the need for feasible and sustainable complementary strategies to increase access and compliance to the intervention in order to reduce the morbidity. The strategy of using community health agents for delivery of antimalarials in the HBMM in Ghana has been tested and found to reduce number of reported fever episodes and increase use of appropriate treatment (Gyapong and Garshong, 2007). A similar strategy with adequate training and supervision can be used to effectively provide IPT to pregnant women in remote and inaccessible areas.

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Chapter 2

Materials and Methods

Chapter 2: Materials and Methods

Study area and population

Study area

The study was conducted in the Afigya Sekyere district of the Ashanti Region of Ghana (Figs. 2.1 and 2.2) with a projected population of 150,498 (DHA, 2007). The district was selected for the study due to its reported high prevalence of anaemia and presumptively diagnosed malaria in pregnancy. The district has now been split into two; namely Sekyere South and Afigya Kwabre districts. The Afigya Sekyere district was divided into six sub districts and had 91communities, most of which are without good road networks. It has an annual growth rate of 3.4%, women in the fertility age (WIFA) form about 22.5% of the population and the expected pregnancy rate is 4% (DHA, 2007). This district is located in the North Central part of the Ashanti Region. It shares boundaries with five districts namely; Ejura-Sekyere Odumase to the North, Sekyere West to the East, Sekyere East and Kwabre to the South and Offinso to the West. The district lies between Latitudes 6° 50′N and 7° 10′N and Longitudes 1° 40′W and 1° 25′W. The district spans a total area of 780 km^2 (approximately 3.27% of the total land area of the region) and lies within the forest belt. The mean annual temperature for the area is 27^0C with annual rainfall between 1500 and 2000mm. The district has a bimodal rainfall pattern. The major rainfall season runs from mid-March to the end of July, while the minor season begins in September and ends mid November. This period is followed by a long dry spell, which ends by mid-March. The peak of the rains occurs in May/June and October with a drier period in between in August. Malaria is highly endemic in the district and there is little seasonal variation in parasite transmission. The indigenous people are Akans. Other settlers in the area are mainly migrants from the northern part of the country. Most of the inhabitants are engaged in subsistence farming and small-scale trading. The main food crops grown are cassava, plantain, maize and rice. Few of the inhabitants also grow cash crops like cocoa, oil palm and timber but generally incomes are very low.

Fig. 2.1 Distribution of malaria in Ghana Source: MARA/ARMA (2005)
Inset: Afigya Sekyere district

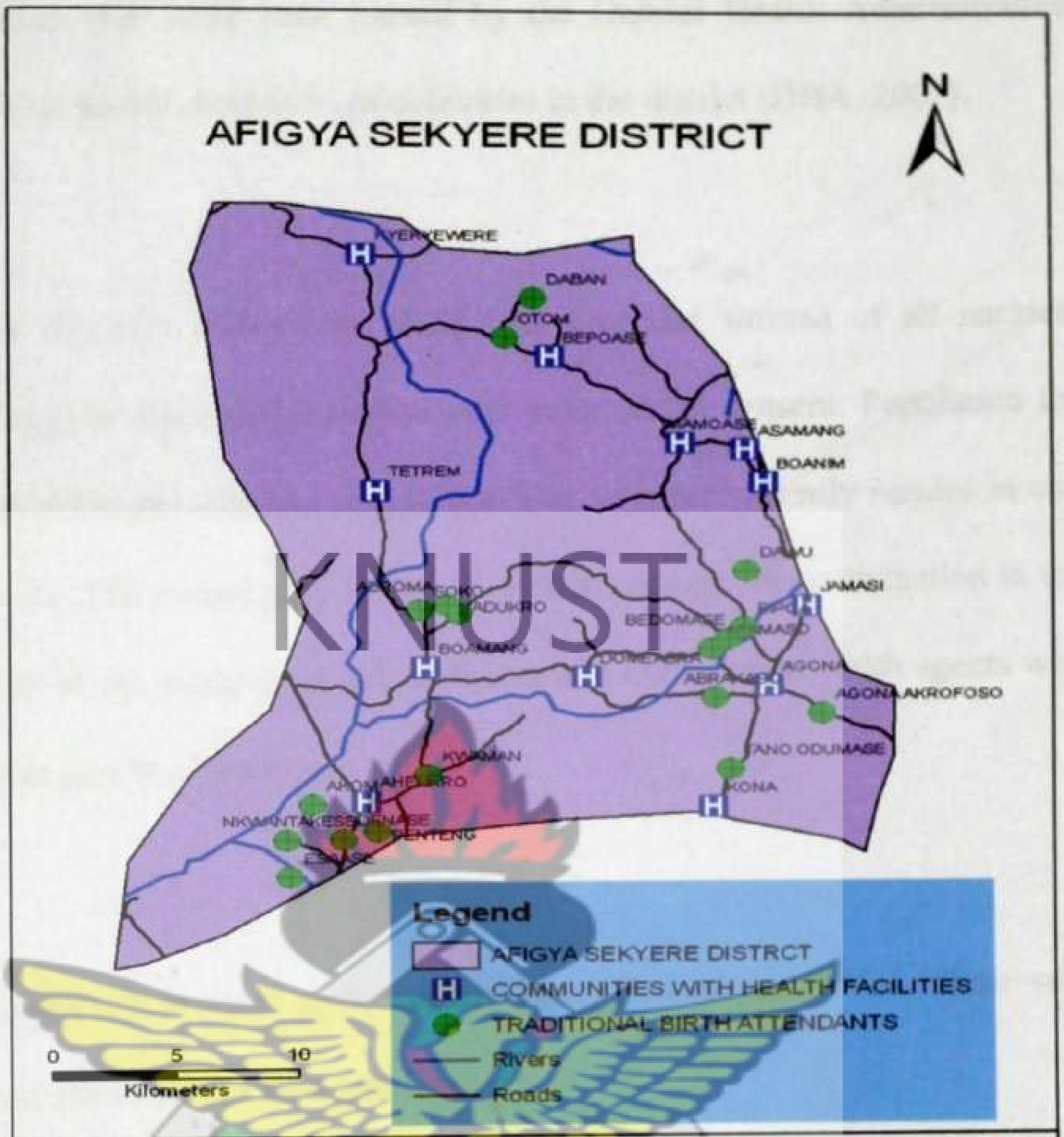

Fig 2.2 Map of Afigya Sekyere district showing health facilities and TBA communities

There are 13 health facilities in the district, made up of nine public facilities and four mission health facilities. Four of the 13 facilities are hospitals and nine are health centres. The health facilities provide both static and outreach services. The outreach clinics mainly provide maternal and child health services. There are recognized community health workers within the district. Each community has one or more community-based surveillance volunteers (CBSVs) who are responsible for surveillance and reporting of diseases within each community. They also support the professional health workers during implementation of outreach programmes and on national immunization days (NIDs). Other CHWs are the traditional birth attendants (TBAs). There are 52 of them who have been trained by the District Health Administration (DHA). These TBAs conduct about 30% of deliveries in the district (DHA, 2002).

Study population

The population for the first part of the study was pregnant women of all parities, community health agents and opinion leaders who gave verbal consent. Population for the second part was primigravidae and secundigravidae who permanently resided in any community within the district and gave informed written consent for participation in the study. The third part of the study involved midwives and community health agents who administered IPTp in part B of the study.

Study design

The study was conducted in three parts namely First, Second and Third. Three sub-studies were carried out under the first part namely;

(i) An exploratory survey on "Perceptions on malaria in pregnancy in the Afigya Sekyere district".

(ii) Factors influencing the distribution of birthweights in Afigya Sekyere district. This was a descriptive study of birthweights recorded in health facility delivery registers between 1999 and 2003 and

(iii) A descriptive study of "Pregnancy-associated malaria and anaemia in the Afigya Sekyere district".

(iv) The Second Part of the study evaluated the implementation of IPTp using community health agents and health facilities. The study used a non-randomised experimental design to assess the effect of IPTp on malaria parasitaemia, anaemia, birthwieght and compliance with IPTp. At the time of starting this part of the study in 2004, IPTp was not being implmeted by the Ghana Health Service in the district. Later, in 2005, the GHS delievered IPTp in two health facilities. However, from 2006 the GHS began implementing routine IPTp in all public health facilities in the district. The Third Part of the study was designed to explore the health providers' perception and also determine access and compliance with the routine IPTp by pregnant women. Data was collected for the entire study from September 2004 to September 2007.

First Part of Study

Exploratory study of perceptions on malaria in pregnancy

The study aimed at exploring the community's perceptions on malaria in pregnancy and health actions taken by pregnant women to protect themselves. Social, cultural and economic factors influencing utilization of ANC and delivery services were also explored.

Three focus group discussions (FGDs) were conducted with pregnant women in three communities. A two-stage sampling method was used to select the participants. First, one community each from three sub-districts was randomly selected. Secondly, in each of the selected communities, names of pregnant women who were willing to participate were compiled and 9-11 pregnant women were randomly selected to form a group for the discussion. The discussions started from naming of common diseases in pregnancy, and then progressed to focus on malaria in pregnancy, its causes, recognition, prevention and treatment. Other points for discussion were anaemia in pregnancy, reasons for utilization and non-utilization of ANC and delivery services. The FGDs were moderated by a graduate in Social Science and another took the notes. The discussions were tape-recorded, transcribed and compared with the notes taken.

Information gathered from the FGDs was used to develop questionnaires. These were translated from English to the local language, Twi and translated back to English to eliminate ambiguity. The questionnaire was pretested with pregnant women in the Ejisu-Juaben district. Two communities were randomly selected from each sub-district for a questionnaire survey. In each of the selected communities, women were selected through convenience sampling for interview due to difficulty in developing a reliable sampling frame because some women were reluctant to disclose early pregnancy due to traditional beliefs of negative effects of early disclosure of pregnancy.

Exit interviews were also conducted with pregnant women at health facilities. Six health facilities were selected through random sampling of one from each sub-district. Interviewers were positioned away from the maternity units. Pregnant women who had finished consultation and were on their way out of the health facility were randomly invited for interview. The interviews were conducted by the researcher and five field assistants who were fluent in the local language and had been trained in administration of the questionnaire. The participants were assured of confidentiality of information and anonymity. Each woman was interviewed only once, either at the health facility or in the community. A total of 543 pregnant women were interviewed. One hundred and eighty-foru (184) of them were interviewed at the health facility and 359 in the communities. Interviews were also conducted with 13 key informants who were CBSVs, TBAs and opinion leaders.

Study on birth weights

The aim was to determine the mean birthweight for the district and to use this in assessing the effect of the intervention implemented in the second phase. Data on birthweight, parity, maternal age, sex of infant, month and year of delivery were retrospectively collected from delivery registers of all 13 health institutions. This data covered records of five consecutive years, from January 1, 1999 to December 31, 2003. Data in delivery registers are entered by professional midwives soon after delivery of a baby. The babies were weighed using a Seca Baby Scale. Almost all facilities recorded weights to the nearest 100gms except Wiamoase Salvation Army Hospital which recorded weights to the nearest 50gms. Mean monthly rainfall data covering the period January 1999 to December 2003 for the district was collected from Ghana Meteorological Services, Kumasi. Months receiving between 0 and 100mm of rain were considered dry months whereas months receiving above 100mm were considered wet months. Thus, January, February, March, August, November and December were the dry months (dry season) whereas April, May, June, July, September and October were the wet months (rainy season).

Survey on prevalence of parasitaemia and anaemia in pregnancy

A cross-section of pregnant women totaling 506 had their blood samples taken for determination of parasitaemia and haemoglobin (Hb) level. This was done at both health facility and in some selected communities. Blood samples were taken from finger pricks from which thick and thin smears were prepared. The thin smears were fixed with methanol by a qualified laboratory technician. Hb levels were measured using a HemoCue® photometer (HemoCue, Sweden). The blood slides were transported to KNUST for processing (see under laboratory procedures).

Second Part of Study

This phase of the study assessed the possibility of using recognized community health agents in implementing IPTp to increase access in remote areas and also test the effect on birthweight, anaemia and parasitaemia.

Sample size determination

The sample size determination was based on comparison of two means from Kirkwood and Sterne (2003). It was estimated that there will be an increase in mean birth weight by 150g in the Community-based intervention (CBI) group compared to the Health facility intervention (HFI) group. Using a power of 80% and a significance level of 0.05 and an assumed standard deviation of 500g, the sample size needed for each group was calculated using the formula:

$$[(u+v)^2(\sigma_1^2+\sigma_2^2)]/(\mu_1-\mu_2)^2$$

where:

u = one-sided percentage point of normal distribution corresponding to power of 80%

v = two-sided point of normal distribution corresponding to significant level at 5%

σ_1 = standard deviation of community group

σ_2 = standard deviation of health facility group

$\mu_1-\mu_2$ = difference in mean

$$N = \frac{(1.96 + 0.84)^2(0.5)^2}{(0.15)^2} = 175$$

Assuming 20% loss to follow-up, 420 women of first and second pregnancy were needed for the study.

Selection of field sites and field personnel

Six health facilities were purposively selected as field sites. One health facility from each sub-district was selected. Using purposive sampling, 18 trained TBAs and 17 community-based surveillance volunteers (CBSVs) were selected. Two field workers (FWs) were permanently employed for the study.

Training of field personnel

Three types of training were conducted before the implementation of IPTp began. The training sessions were facilitated by the researcher, the district public health nurse, a laboratory technician, with support from the district malaria focal person. First, the two FWs were trained and their knowledge updated on malaria, with emphasis on malaria in pregnancy and IPTp. They were trained in data collection, interviewing, monitoring drug administration, preparing blood smears, checking Hb, weighing of babies and record-keeping.

The second training was a three-day session organised for the selected trained TBAs and CBSVs. Each TBA was paired with a CBSV to form a community-based intervention (CBI) team. The training focused on: malaria in pregnancy and its adverse effects, malaria prevention strategies and the use of SP for prevention. They were trained in:

- Drug storage and administration
- Interviewing
- checking haemoglobin levels (Hb)
- Taking peripheral and placenta blood and preparing slides
- Weighing of babies

- Record keeping
- Recognizing imminent complications in pregnancy

They were also taken through exercises of filling the study forms.

The third training was a one-day session held for all the midwives in the district. Their knowledge on malaria in pregnancy was updated and they were trained in:

- Preparation of thick placenta blood slides
- Hb measurements
- Interviewing
- Record keeping

Each health facility and each CBI team was provided with a notebook for entry of records on all women they recruited. In all the training sessions, the outcome of the exploratory study on perceptions on malaria in pregnancy was presented. This was intended to inform the participants of local beliefs on malaria in pregnancy to enable them provide appropriate health education.

Enrolment of study participants

Midwives, trained TBAs and CBSVs recruited women at ANCs and in communities, explained the study to them, and recorded their demographic data and any reaction to antimalarials. They confirmed non-palpable pregnancies by testing the women's urine with a dipstick (QTEST™ HCG Pregnancy Urine Dipstick). Eligible women who gave their consent by signing or thumb-printing a consent form were enrolled into the study. Laboratory technicians in health institutions and the FWs took blood samples for Hb measurement and blood slides for malaria diagnosis. The researcher and FWs visited field sites and confirmed information with the recruited women. A unique identity number was given to each study participant and was recorded on the ANC cards of those who attended ANC so that SP will not be repeated in a period less than a month.

Inclusion criteria

The inclusion criteria were primigravidae and secundigravidae who:

- had no reported allergy to sulphur containing drugs
- had no chronic diseases
- had Hb of 7g/dl or above
- were permanently resident in the district

Drug administration

IPTp was administered by midwives and community health agents using a directly-observed therapy (DOT) strategy. The IPTp by midwives was refered to as Health Facility Intervention (HFI) and that by the community agents was refered to as Community-Based Intervention (CBI). Study women received a dose of SP (1500mg sulphadoxine/75mg pyrimethamie) with daily iron and folate from a HFI or a CBI. It was planned for each woman to receive IPTp three times, beginning from 16 weeks gestation or when quickening had taken place. The interval between doses was at least one month. At each subsequent visit, the women were interviewed on any adverse events following the intake of SP. The women were informed to immediately report to the health facility with any fever episodes or adverse events they might experience. The HFI and CBI providers were supplied weekly with drugs and laboratory resources.

Laboratory procedures

Midwives, CBI teams, FWs and laboratory technicians had regular supply of slides, slide boxes, lancets, microcuvettes, gloves, cotton wool and methanol to prepare and store blood slides. Blood samples were taken from each woman at recruitment before the first dose of SP, then before each subsequent dose and at 36 weeks gestation. At delivery a blood slide was also prepared with blood taken from an incision made in the maternal surface of the placenta. All blood slides from the HFI and CBI were collected by the FWs and transported to KNUST for processing. All blood slides collected were stained with 10% Giemsa solution and examined by light microscopy using an oil immersion objective x 100. Parasitaemia was determined per microlitre (μl) of blood by counting the number of asexual parasites per 200 white blood cells, assuming 8000 leukocytes/μl and multiplying the parasite count by 40. A slide was considered negative if no parasites were found within 200 high power fields. Ten percent of the slides were randomly selected and read by another technician at the Komfo Anokye Teaching Hospital (KATH) for quality control purposes. The research team and FWs visited field sites to provide technical support.

Procedures during delivery of baby

Salter® scales (UNICEF Super Samson Salter) were provided for all community agents for weighing the babies. All the babies delivered at the health facilities and by TBAs were weighed within 7 days of delivery. The weights were recorded either in the field notebooks or in the health facility's delivery registers and on the delivery form. Monitoring visits were made by the researcher and FWs to weigh some babies and compare with the provider's weight to ensure accurate recording of birth weights.

Referrals

Five women were referred to Asamang SDA Hospital, Mampong Hospital, Offinso Government Hospital and the Komfo Anokye Teaching Hospital, Kumasi. Four were referred on account of delayed second stage of labour and one was due to retained placenta. Follow-up visits were made to the health facilities for records on the women. The women were also visited and interviewed on their experiences.

Research team meetings

Meetings were initially held monthly with the IPTp providers to assess implementation and address challenges. The meetings with midwives were later held quarterly due to time constraints because most of the health facilities had only one midwife at post. The two FWs took part in all scheduled meetings and the DHMT was always represented by the acting Director of Health Services or a Public health nurse.

Third Part of Study

Data collection on routine IPTp at health facilities

Data was collected on IPTp from all the health facilities in the district for the period of 2005 – 2007. Four research assistants were trained in data collection and they were supported by the midwives and health care assistants in the maternity units to collect information from the ANC register and IPTp administration notebooks. The data focused on ANC attendance, gestation at first attendance, age, parity and number of IPTp doses received. Data was also collected from the District Health Administration on the supply of SP to the health facilities.

Health care providers' perceptions on IPTp

Key informant interviews (KII) were held with midwives. They were interviewed on their perception of the IPTp implementation process, focusing on access and compliance. Community health agents (TBAs & CBSVs) who participated in the community IPTp were also interviewed on their experiences with the process. Questions asked covered their perceptions of the strength and weaknesses of implementing IPTp, challenges of access and compliance and how to improve the implementation of IPTp.

Data processing and analysis

Data gathered at every stage of the study was entered into notebooks and into Microsoft Access on a continuous basis. Forms with identified errors were returned to the field for correction. In the qualitative study, open-ended responses were recoded, frequencies determined and results presented. Logistic regression was used to determine the relationship between respondents' demographic and socioeconomic status and the use of ITN. Descriptive statistics was mainly used in the analysis of the baseline birthweight study. Low birthweight was defined as birthweight <2500g. Seasonal variability in birthweight distribution was determined by averaging the monthly means over the observed years. Multiple linear regression was used to identify factors influencing birthweights.

Quantitative data from the cross-sectional survey and the intervention study was analysed based on the endpoints of the study using STATA version 8 (Stata corp. College Station, Texas, USA) and SPSS® for Windows® version 16.0 (SPSS Inc. 2007, USA). Mean difference in Hb and parasitaemia at baseline and after intervention was determined. Mean Hb and birthweight were analysed using ANOVA to test for effect of dosage and the difference was compared between the HFI and CBI groups.

Outcome variables

- Timing of IPTp (gestational age in weeks at first dose of SP)
- Proportion of women who completed three doses of SP
- Mean Hb and proportion of anaemia and severe anaemia
- Mean birthweight and proportion of LBW babies
- Prevalence of peripheral parasitaemia and parasite density
- Prevalence of placenta parasitaemia
- Proportion of women who accessed routine IPTp

Ethical considerations

1. Ethical approval for the study was obtained from the following:

- Committee on Human Research Publications and Ethics of the School of Medical Sciences, KNUST, Ghana.
- Danish National Committee for Biomedical Research Ethics, Denmark

2. Administrative approval was obtained from the Afigya Sekyere DHMT. All heads of health institutions in the district were formally informed by the DHMT and information meetings were held with midwives and recognized community health agents and verbal consent obtained.

3. Informed verbal consent was obtained from participants in all the baseline studies. Consent was also obtained from chiefs and community leaders after explanation of the objectives of the study. Written consent was obtained from eligible women who participated in the intervention study. Participants were asked to either sign or thumb-

print a consent form. Confidentiality of information gathered was ensured bu ensuring that only the research team had access to the data.

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Chapter 3

Perceptions on malaria in pregnancy in the Afigya Sekyere district

RESULTS AND DISCUSSIONS

Chapter 3

Perceptions on malaria in pregnancy in the Afigya Sekyere district

Chapter 3: Perceptions on malaria in pregnancy in the Afigya Sekyere district

Abstract
Malaria in pregnancy poses serious threats to the woman and her foetus. These include anaemia, increased risk of miscarriage and delivery of low birthweight babies which has serious implications for the health and survival of the neonate. Pregnant women's perception of malaria is important for the successful implementation of any malaria control program. A study was therefore conducted to explore perceptions of pregnant women, community health agents and opinion leaders in the Afigya Sekyere district of Ghana on malaria in pregnancy. Malaria was mentioned as the most common illness among pregnant women. The communities had good knowledge on the causes and symptoms of malaria, and the adverse consequences of malaria on pregnancy and maternal health. Mosquito bite was identified as the major cause of malaria in pregnancy. Knowledge on the association between malaria and anaemia was limited and was significantly associated with educational status of the respondents. Majority (61.3%) of the respondents perceived that anaemia is largely due to poverty. The level of knowledge about causes, symptoms and consequences of malaria and anaemia on pregnancy and preventive practices was similar between the pregnant women, TBAs, CBSVs and Opinion leaders. ANC attendance and knowledge about insecticide-treated net (ITN) use were high but actual ITN use was very low, suggesting the influence of other factors in knowledge implementation. The support of husbands was identified as important for patronage of ANC and delivery services, and implementation of relevant malaria control actions. To improve malaria control in pregnancy, there is the need to intensify education aiming at decreasing perceived barriers to behavioural change. Health education and promotion packages should also be targeted at men or husbands.

The association between malaria and anaemia needs to be emphasized in health education and promotion programmes.

Introduction

Malaria is a major public health problem in Ghana. It accounts for about 44.1% of all out-patient cases and approximately 22% of deaths in children below five years of age (GHS, 2007). The prevalence of pregnancy associated malaria in Ghana is 13.1% (MOH/GHS, 2008). Pregnancy renders a woman more susceptible to malaria especially during the first pregnancy (Singh *et al*., 1999). Pregnant women are more likely to have a higher level of parasitaemia than their non-pregnant counterparts, increasing the risk of maternal anaemia, abortion, stillbirth, prematurity, intra-uterine growth retardation (IUGR), and having infants of low birthweight (Phillips-Howard, 1999). The prevalence of pregnancy associated malaria varies depending on transmission levels, with reported rates ranging from 11.9% to 57.8%. (Diagne *et al.*, 1997; Singh, 1999; Newman *et al.*, 2003; Geertruyden *et al.*, 2005; Coulibaly *et al.*, 2007; Kayentao *et al.*, 2007). Effective preventive measures being currently implemented are the use of ITNs, chemoprophylaxis and intermittent preventive treatment (IPTp) combined with health education to facilitate uptake of these interventions.

High ANC attendance has been reported in Ghana but with low use of malaria preventive measures by pregnant women even in situations where bednets were free (Browne *et al.*, 2001; MOH, 2002, MOH/GHS, 2008). The use of any form of mosquito nets has been reported to be between 11-20% in Ghana (WHO, 2005). Factors such as lack of knowledge or inadequate information on the consequences of malaria in pregnancy and socio-economic factors might explain the low use of ITNs.

Recently, the role of socio-cultural factors in adopting treatment and prevention practices for successful malaria control has been highlighted (Heggenhougen *et al.*, 2003; Launiala and Kulmal, 2006). Understanding the factors influencing health seeking behaviour among pregnant women is critical to the successful implementation of malaria intervention programmes. Studies on knowledge, attitudes and practices (KAP) have become equally important to improve control activities (Shultz *et al.*, 1994; Espino *et al.*, 1997). Hence, the study and analysis of knowledge and perceptions in malaria endemic communities will not only contribute to knowledge to improve the design and implementation of malaria control programmes but will also encourage active participation of the communities. In Ghana, however, most of the KAP studies have been conducted in the general population, with focus on malaria in children and there is limited information on KAP regarding malaria in pregnancy. The objective of this study was to explore and describe people's knowledge and perceptions about causes, symptoms, effects, preventive measures and sources of treatment for malaria in pregnancy.

Materials and Methods

Study area

The study area has been described in detail in Chapter 2. In brief, women in the fertile age group (15-45 years) form about 22.5% of the population, with an expected pregnancy rate of 4% (DHA, 2007). The district lies within the area of high, stable and perennial malaria transmission (Browne *et al.*, 2000). The major rainy season runs from mid-March to the end of July, while the minor rainy season begins in September and ends mid November.

Study design

This was an exploratory and descriptive study using both qualitative and quantitative methods to explore community perceptions on malaria in pregnancy. Focus group discussions (FGDs) and a questionnaire survey were conducted. The study was conducted between February and April 2005.

Selection of communities and participants

For the FGDs, a multi-stage sampling method was used. First, three subdistricts were randomly selected from the six subdistricts. One community from each of the three selected sub-districts was also randomly selected. In each selected community, 9-11 pregnant women were randomly chosen to form a focus group.

In the questionnaire survey, the sample size of 545 was calculated as 10% of the expected number of pregnancies from the 2004 population. Convenience sampling method was used to select the respondents. Two communities and one health facility from each sub-district were randomly selected for the administration of the questionnaires.

Data collection methods

Focus Group Discussions

The FGDs are described in details in chapter 2. In brief, three FGDs were conducted in three communities. Prior to the discussions, chiefs and opinion leaders, CBSVs and TBAs were informed of the objectives of the study. The CBSVs identified the pregnant women, informed them about the study and invited them to participate on a pre-determined date. Discussions started from general issues on women's health and progressed to specific malaria-related issues. A small token gift was given to participants after the FGDs.

Questionnaire survey

Structured questionnaires developed from the FGD responses were translated from English to the local language, Twi. Open-ended questions were incorporated into the questionnaire to elicit responses that the FGD participants may not have given. The structured questionnaires were pretested and the process implemented as described in chapter 2. The community interviews were conducted in the woman's home or wherever she considered suitable, for example under the shade of a tree. The participants were assured of confidentiality of information and anonymity. Women were interviewed on their ANC attendance and their ANC cards were verified to validate their responses. In-depth interviews were also held with 13 community opinion leaders, TBAs and CSBVs.

Data Analysis

Responses from the transcription of the FGDs were validated with the notes taken during the process. The responses were entered into Microsoft Word, manually analyzed and grouped under major headings of illnesses in pregnancy, malaria, anaemia and utilization of ANC and delivery services.

The quantitative data was entered into Microsoft Access, cleaned and imported into SPSS version 16 for analysis. Responses to open ended questions were coded. The data was analyzed using descriptive statistics to determine the beliefs and perceptions generally held by the communities. Chi-square analysis was used to compare proportions. Logistic regression was used to determine the relationship between respondent's demographic and socioeconomic status and use of ITN. Odds ratio was also used to measure the association between respondents educational status and gravidity in relation to their perceived illnesses in pregnancy, causes, symptoms and and consequences of malaria and anaemia in pregnancy.

Results

Perceptions by FGD participants

The women who participated in the FGDs were between 18 and 37 years of age. The majority of them had formal education to the Junior Secondary School level. They were farmers, traders or unemployed. The groups comprised primigravidae and multigravidae with the highest gravida being 7. Gestational age ranged between 4-9 months. The health problems identified by the participants as prevalent in pregnancy included malaria, fever, stomach ache, vaginal discharge, pains on micturition, dizziness and swollen feet.

Participants were very familiar with the term 'malaria'. The condition is synonymous with the local terms *Atridii* and *Yare fufuo*. *Atridii* describes the situation where the individual has a combination of symptoms such as headache, hot body, catarrh and cold while '*Yare fufuo*' symbolizes pallor. The women perceived that the consequences of malaria in pregnancy are serious and sometimes fatal. The consequences they enumerated were abortion, bleeding, delivering a weak baby, baby will have yellow eyes and foetal death. Participants mentioned both biomedical and traditional sources of malaria treatment. The following statements are examples of some traditional sources of malaria treatment that they indicated.

> *'There are these herbs called gyenegyene and nantwebini* ***(Maniophylum flavium)*** *which you can use to bath and drink as well'* (A 37 year old multigravida).

Another 32 year old multigravida indicated that:

> *'There is a herbal medicine called nkwadankwadaa boodie (Cassia laevigata). You can use it to prepare soup and when you eat it you will urinate a lot'.*

It was observed and inferred from the discussions and interactions that this herbal preparation with *Cassia laevigata* is well known to the pregnant women and is sometimes used as enema for children with malaria. They believed the preparation cleanses the body of dirt based on another belief that malaria is caused by dirt.

The use of another treatment was expressed like this:

'We use kokrodoso. You boil it and drink it'. 'You can also use pineapple peels and lemon'.

The *kokrodoso* is a preparation made from mixed spices and the bark of Mahogany tree.

Other issues discussed were on anaemia and the use of maternity services. Anaemia is called *mogyawie* meaning diminishing blood, hence their perception of a pregnant woman with anaemia is 'one who does not have enough blood' or' has lost blood'. The condition was perceived to be a threat to the well being of the woman and the foetus.

The reasons given for patronizing ANC services were: to know the position of the baby, it is mandatory for pregnant women to visit the hospital, availability of drugs, and ill-health. Reasons for non-patronage of ANC were financial constraints, use of herbs, lack of financial support from husbands, and negative attitudes of some health staff. The main complain about staff attitude was that the staff shout at the women during labour.

The reasons given for delivering at health institutions include the competence of staff, availability of drugs and facilities to take care of emergencies. They acknowledged that some women attend ANC but deliver with TBAs or at home and indicated this was mainly due to financial constraints. Their suggestions to improve health facility patronage include education of husband on ANC benefits, reduction of items to be paid for at delivery and financial or material support from government. They recommended the suggestion of one participant that:

> *'The video shown at the hospital should also be shown here (the community) so that other pregnant women may know the benefit of visiting the hospital'. (A 32 year old multigravida)*

Questionnaire survey

Background characteristics of pregnant women

A total of 543 women were interviewed, 184 of this at health facilities and 359 in the communities. Their age ranged between 13 and 44 years and the majority (52.2%) were between 20 and 29 years (Table 3.1a). About 87% of them were married or co-habiting. Most of the respondents were literate with education up to Junior Secondary School level. Majority (54.3%) of the women were in their third trimester and 6.4% were in their first trimester (Table 3.1b). Ownership of radio was the commonest among the socioeconomic indicators studied (Table 3.2).

Table 3.1a. Socio-demographic characteristics of respondents

Variable	No of respondents (N)	% of Total
Age (years)	**n=542**	
<20	88	16.2
20 – 29	283	52.2
30 – 39	147	27.1
40 – 44	24	4.4
Marital status	**n=534**	
Single	65	12.2
Married/cohabiting	467	87.5
Divorced	1	0.2
Widowed	1	0.2
Education	**n=531**	
None	65	12.2
Primary	37	7.0
Middle School	106	20.0
Junior Secondary	289	53.2
Secondary/Higher education	34	6.3
Occupation	**n=541**	
Unemployed	143	26.5
Farmer	148	27.4
Trader	148	27.4
Artisan	97	17.9
Government employee	5	0.9

Table 3.1b. Socio-demographic characteristics of respondents

Variable	Number of respondents (N)	% of Total
Religion	**n=523**	
Traditional	23	4.4
Christianity	425	81.3
Islam	75	14.3
Gravida	**n=543**	
1	159	29.3
2	111	20.4
3-5	273	50.3
Trimester	**n=534**	
1	34	6.4
2	210	39.3
3	290	54.3

Table 3.2. Indicators of socioeconomic status among respondents

Indicator	Yes %	No %	Total (N)
Tap water	8.4	91.6	537
Latrine	28.4	71.6	538
ITN use	24	76.0	538
Motorbike	2.6	97.4	538
Bicycle	24	76.0	543
Radio	90.1	9.9	538
Mobile phone	23.5	76.5	543

Perceptions of common ilnesses

The illnesses identified by respondents during the questionnaire survey were similar to those mentioned by the FGD participants. Clearly, the pregnant women (58.9%) and the TBA, CBSV and opinion leaders group (100%) perceived malaria as the commonest illness during pregnancy (Table 3.3). The TBA, CBSV and opinion leaders group recognized anaemia as the next most frequent illness in the area. In contrast, the pregnant women rated stomach ache, waist pain and vomiting as other more frequent illnesses experienced during pregnancy (Table 3.3).

Table 3.3. Perceived illnesses affecting pregnant women in the Afigya Sekyere district, Ghana

Perceived Illness	Pregnant women (N = 543)		TBAs, Opinion (N=13)	CBSV, leaders
	N	% *	N	% *
Malaria	320	58.9	13	100.0
Stomach ache	45	8.3		
Waist pain	45	8.3		
Vomiting	41	7.6	1	7.7
Anaemia	27	5.0	6	46.2
Fever	21	3.9		
Headache	12	2.2		
Cough	9	1.7		
Jaundice	8	1.5		
Swollen feet (Oedema)	7	1.3	2	15.4
Lower abdominal pain	6	1.1	1	7.7
Bleeding	4	0.7	1	7.7
Eclampsia			1	7.7

** % add up to > 100 as multiple responses were allowed*

Perceptions on malaria

The women recognized malaria mainly by the biomedical symptoms. Headache, vomiting, fatigue, fever/hot body and pallor were the symptoms mentioned most (Table 3.4). The TBA, CBSV and opinion leaders group ranked pallor (69.2%), fatigue/weakness (30.8%) and loss of appetite as the most occurring symptoms in pregnancy (Table 3.4).

Table 3.4. Perceived symptoms of malaria by respondents

Perceived Symptom	Pregnant women (N = 543)		TBAs, CBSV, Opinion leaders (N=13)	
	N	% *	N	% *
Paleness	136	25.0	9	69.2
Headache	134	24.7	1	7.7
Vomiting	125	23.0	1	7.7
Fatigue, weakness	125	23.0	4	30.8
Fever/Hot body	107	19.9		
Loss of appetite/bitter taste in mouth	80	14.7	3	23.1
Nausea	23	4.2		
Yellowish eyes, urine, jaundice	16	2.9	2	15.4
Dizziness	14	2.6		
Chills	10	1.9	1	7.7
Loss of weight			2	15.4
Difficulty in breathing			1	7.7
Scanty and dark urine			1	7.7

** % adds up to > 100 as multiple responses were allowed*

Both pregnant women (78.8%) and the TBAs, CBSVs and opinion leaders group (53.8%) perceived mosquito bites as the main cause of malaria (Table 3.5). Similarly, pregnant women (14.7%) and TBAs, CBSVs and opinion leaders group (30.8%) perceived unclean environment or drinking of unclean water as the second major cause of malaria in the district (Table 3.5).

Table 3.5. Perceived causes of malaria by respondents

Perceived causes of malaria	Pregnant women (N= 543)		TBAs, CBSVs and Opinion leaders (N=13)	
	N	%*	N	%*
Staying in the hot sun	29	5.3		
Eating oily food	52	9.6	2	15.4
Eating starchy foods	8	1.5	2	15.4
Mosquitoe bite	427	78.8	7	53.8
Unclean environment/Drinking dirty water	80	14.7	4	30.8
Eating cold foods	13	2.4		
Food contaminated by houseflies	12	2.2		
Poor diet	10	1.8		
Failure to attend ANC			2	15.4
Strenuous work			1	7.7

** % adds up to > 100 as multiple responses were allowed*

Malaria preventive measures enumerated were: environmental cleanliness, sleeping under a mosquito net, using insecticide spray, draining gutters with stagnant water, avoid eating oily foods, prevent contamination of food by houseflies, eating well/balanced diet and practicing personal hygiene. Majority (79.6%) of the pregnant women were of the opinion that protecting oneself against mosquito bites and practicing environmental hygiene (30.8%) are the two key methods of preventing malaria.

Respondents indicated the use of both biomedical and traditional sources for treatment of malaria during pregnancy. Health facility (92%), herbs (4.8%), chemical shops (2.8%) and self medication (1.7%) were mentioned by the pregnant women as the sources of malaria treatment. In contrast, the TBA, CBSV and opinion leaders group indicated health facility (100%) and TBA (30.8%) as sources from which pregnant women receive malaria treatment. The pregnant women indicated chloroquine (24.3%) and paracetamol (23.9%) as the treatment for malaria they received from the health facilities. A few of them mentioned fansidar (2.6%). Similarly, the TBA, CBSV and opinion leaders group mentioned chloroquine (46.2%) and paracetamol (46.2%) as treatments for malaria. Other treatments mentioned were herbal preparations (7.7%) and use of enema (7.7%).

The pregnant women indicated small baby (8.9%), anaemia (2.2%), abortion (19.5%), stillbirth (17.7%), premature birth (26.2%), and maternal death (23%) as consequences of malaria. Similarly, the TBA, CBSV and opinion leaders group mentioned abortion (38.5%), stillbirth (30.8%), anaemia (15.4%), premature birth (15.4%), low birthweight baby (15.4%) and maternal death (7.7%) as consequences of malaria.

Perceptions on anaemia

Majority (61.3%) of the pregnant women attributed anaemia to poverty, while 16.6% attributed it to malaria and 4.6% to worms (Table 3.6). Anaemia prevention measures mentioned were eating balanced diet (66.7%), taking ANC drugs (14%), herbal preparations (1.8%), protecting oneself against malaria (3.7%) and doing less strenuous work (1.2%). Women perceived eating of palm nut soup, eggs and leaves like *kontomire* (tender cocoyam leaves), *ayoyo (Chorchorus olitorius),* cassava leaves and taking blood tonic as measures that could be used to treat anaemia in pregnancy.

Table 3.6. Causes of anaemia as perceived by pregnant women

Perceived causes of anaemia	**No.**	**%**
Poverty	332	61.3
Malaria	90	16.6
Worms	25	4.6
Oily food	12	2.2
Foetus	15	2.8
Strenuous/Too much work	8	4.5
Fever	6	1.1
Heat & Long stay in the sun	6	1.1
Not taking ANC drugs	14	2.6

Table 3.7. Perceived symptoms of anaemia by respondents

Perceived symptom	Pregnant women (N = 543)		TBAs, CBSV and Opinion leaders (N = 13)	
	N	%	N	%*
Paleness of eyes and palm	325	59.9	13	100.0
Loss of appetite	64	11.8	1	7.7
Fatigue/weakness	56	10.3	2	15.4
Dizziness	49	9.0	1	7.7
Weight loss	21	3.9	4	30.8
Bleeding during delivery	13	2.4		
Oedema of hands and feet	6	1.1		
Yellowish eyes/jaundice	5	0.9		
Sleeplessness			2	15.4

** % adds up to > 100 as multiple responses were allowed*

Utilization of ANC and delivery services

Majority (75.9%) of the women lived within 5km distance from health facilities and 58% lived within walking distance of one kilometer or less to the facility. Of the 543 women interviewed, 488 (89.9%) said they attended ANC and 483 (99%) were validated through inspection of ANC cards by interviewers. Frequency of ANC visits made at the time of the study ranged between 1 and 5 with an average of 3 visits per person. Majority (84.2%) of the women indicated that they would deliver at the health facility, stating benefits such as safe delivery, availability of drugs and competence of health workers as reasons influencing their choice. Reasons given by the 15.8% who indicated that they would deliver with a TBA or at home were high cost of items to be brought to the health facility for labour, high cost of delivery, non-availability of transport, high transport cost, previous experience with TBA, low cost of TBA service and trust in competence of TBA.

The study also explored the relationship between socio-economic and socio–demographic factors and ITN use. Significant relationships were observed between ITN use and age *(p=0.044)*, access to mobile phone *(p=0.004)*, knowledge of malaria as common illness in pregnancy *(p=* 0.048*)* and number of antenatal clinic visits (p=0.015) (Table 3.8). The negative slope for number of antenatal clinic visits suggests that the more the pregnant women visited antenatal clinic, the less they used ITN (Table 3.8)

Secundigravidae were more likely to perceive waist pain (OR 1.99; 95% CI 0.65 – 5.40) as a pregnancy associated illness than Primigravidae (Table 3.9a). Similarly, secundigravidae were 1.16 times (OR 1.16; 0.71 – 1.89) more likely to associate palor with pregnancy than primigravidae (Table 3.9a). Unclean environment as a perceived cause of malaria, and pallor as a perceived sign of anaemia were associated with educational status (Table 3.9b).

Table 3.8. Relationship between socio-demographic and socioeconomic characteristics of pregnant women and ITN use

Variable	B	S.E.	df	Sig.	Exp(B)
Age	-.067	.034	1	.044	.935
gravidity	.264	.158	1	.093	1.303
gestation	.012	.050	1	.801	1.013
marital	-.535	.426	1	.209	.586
education	-.064	.134	1	.633	.938
occupation	-.169	.100	1	.092	.845
religion	.331	.317	1	.297	1.392
access to motorbike	-.114	.708	1	.872	.892
access to radio	.227	.461	1	.623	1.255
access to mobile phone	.773	.268	1	.004	2.165
number of antenatal clinic visit	-.245	.101	1	.015	.783
distance of health facility from home	-.106	.179	1	.556	.900
knowledge of malaria as common illness in pregnancy	.537	.272	1	.048	1.712
mention of mosquito bite as cause of malaria	-.061	.320	1	.848	.940
Constant	2.124	2.247	1	.345	8.362

Table 3.9a. Association between gravidity of respondents and their perceived illnesses, causes, symptoms and consequences of malaria and anaemia in pregnancy

Gravidity	Perceived illness or symptom in pregnancy		Odds Ratio	95% CI
	Yes	No		
		Anaemia		
1	2	157	-	-
2	10	101	0.13	0.03 – 0.60
3-5	15	257	0.22	0.05 – 0.97
		Waist pain		
1	11	148	-	-
2	4	107	1.99	0.65 – 5.40
3-5	30	242	0.60	0.32 – 1.21
		Malaria		
1	87	72	-	-
2	62	49	0.96	0.59 – 1.56
3-5	170	102	0.73	0.49 – 1.08
		Pallor		
1	89	70	-	-
2	58	53	1.16	0.71 – 1.89
3-5	179	94	0.67	0.45 – 1.00

Table 3.9b. Relationship between educational status of pregnant women and their perceived causes, symptom and consequences of malaria and anaemia in pregnancy

Educational status	**Perceived cause, symptom and consequence of malaria**		**Odds Ratio**	**95% CI**
	Yes	No		
	Unclean environment			
None	18	47	-	-
Primary	17	127	2.86	1.36 – 6.01
Higher	47	285	2.32	1.24 – 4.34
	Stillbirth as perceived consequence of malaria in pregnancy			
None	3	62	-	-
Primary	33	111	0.16	0.05 – 0.55
Higher	54	267	0.24	0.07 – 0.79
	Malaria as perceived cause of anaemia in pregnancy			
None	4	61	-	-
Primary	32	112	0.23	0.08 – 0.68
Higher	53	269	0.33	0.16 – 0.96
	Pallor as perceived sign of anaemia			
None	48	17	-	-
Primary	80	64	2.26	1.19 – 4.30
Higher	192	130	1.91	1.05 – 3.47

Discussions

The term 'malaria' was very familiar to the study population, similar to findings from other parts of Ghana (Adongo *et al.,* 2005; NetMark, 2005). Synonyms like *Atridii* and *Yare fufuo* were used by the respondents. Many women were aware of mosquito bite as the cause of malaria and the link between breeding of mosquitoes and environmental factors though some respondents perceived long stay in the sun and eating oily and starchy foods as causes of malaria. Similarly, important symptoms of malaria such as headache, vomiting, fever, pallor and weakness were well known to FGD participants and questionnaire respondents. Knowledge on preventive methods was also well established. Though a lot of the women attended ANC where the use of ITN was emphasized as a preventive measure for malaria and this was widely known by the women, this did not translate into appropriate action, indicating the influence of intervening factors. The study results corroborated other findings that knowledge and behaviour change have no simple and direct relation (De la Cruz *et al*., 2006; Adongo *et al*., 2005).

There has been increasing recognition of the need to understand treatment seeking behaviours that are relevant for malaria prevention (McCombie, 1996). The respondents indicated multiple causes, preventive methods and treatment for malaria similar to other findings in Ghana and other parts of Africa (Ahorlu *et al*., 2007; NetMark, 2005; Nuwaha, 2002). Majority of the respondents mentioned mosquito as a transmission agent and this can be attributed to the education given at the ANC and through electronic media, considering the fact that majority of them attended ANC and had access to radio. Treatment seeking is however related to cultural beliefs about the cause and cure of illness (McCombie, 1996). Hence, respondents' knowledge of the mosquito as a major transmission agent of malaria offers a window of hope for the uptake of interventions aimed at controlling malaria. Large proportions of malaria cases have been reported to be treated outside of the official health system (Agyepong, 1992; McCombie, 1996; Nieto *et al.,* 1999; Ahorlu *et al*., 2007). Also, the choice of treatment has been shown to be affected by a number of factors including access, cost, attitudes of providers, and beliefs about the disease (McCombie, 1996; McComick-Brown, 1999). The present study identified the use of alternative sources of treatment such as self medication, herbal preparations and chemical shops due to cost, access and beliefs.

The kind of job an individual does seem to have an influence on his health status. Results from earlier studies in Ghana have linked strenuous or hard work with ill-health (Avotri and Waters, 1999; De la Cruz *et al.,* 2006). In the study by Avotri and Waters (1999), the respondents perceived that their health problems emanate from their work roles. These study participants share similar socio-economic background with respondents of the present study, who were mainly traders and farmers. The women felt their social responsibilities made too much demand on them so they had to work more than necessary which affected their health. Respondents of the current study's attribution of malaria to long stay in the sun and anaemia to poverty and too much work could be linked to their occupation because by the nature of their jobs (farming and trading) they are most of the time exposed to the heat of the sun. In addition, because most of them are peasant farmers with irregular and generally low incomes they will have to do some extra work to meet the family's needs.

The findings on anaemia are similar to those from the MotherCare project in eight developing countries which showed that women recognize anaemia by symptoms rather than by a specific disease (Galloway *et al*., 2002). The MotherCare project found that participants attributed anaemia largely to poverty as observed in the present study. The perceived association between anaemia and poverty by the respondents may have serious implication for malaria control efforts as it is likely to pose a barrier to the utilization of anti-malarial interventions by pregnant women. The perceived link between anaemia and poverty also suggests that these respondents may not have perceived the seriousness and their susceptibility or personal risk to anaemia. Whereas the perception of seriousness of a disease is often based on medical information or knowledge, it may also come from beliefs a person has about the difficulties a disease would create or its effects on her life (McCormick-Brown, 1999). Perceived vulnerability to disease and disease severity combine to form a 'threat' and that threat perception motivates an action (Rosenstock, 1974). Whereas the study participants of Galloway *et al*. (2002) mentioned hard work and working in the sun as causes of malaria, the findings in this study linked these perceived causes to anaemia suggesting that people from different cultural backgrounds may perceive a particular disease and or its cause(s) differently based on their beliefs and practices. The respondents in the present study had limited knowledge on the link between malaria and anaemia and this inability to associate malaria with anaemia has serious implications for the prevention of deaths that occur due to complications resulting from anaemia. Steketee *et al.* (2001) attributed 3-15% of anaemia in pregnancy to malaria and about 40% of low birtheight (LBW) is as a result of malaria (Brabin and Piper, 1997). Anaemia also contributes significantly to the incidence of LBW. If the women did not identify malaria as a major cause of anaemia and associated this with the serious and fatal consequences of malaria in pregnancy, then they are not likely to take the necessary preventive actions.

Similar to the findings of Schultz *et al.* (1994), women who attended ANC were significantly more likely to deliver at a hospital or clinic hence most of our study participants indicated that they would deliver at health facilities. Safe delivery, availability of drugs and competence of health workers were some of the factors motivating them to deliver at health facilities. The minority who perceived less positively about the quality of care provided by health staff were more likely to deliver with TBAs or at home (Duong *et al*., 2004). Some multigravidae ANC attendants who indicated preference for TBA assisted delivery cited financial constraints, previous experience with the TBA and their previous childbirth experience as reasons for their choice. The financial constraints could be the likely reason the respondents recommended that husbands should be targeted for education on maternity services. Biratu and Lindstrom (2006) have also reported that the support and approval of husbands influence use of maternity services in Ethiopia.

Conclusions

The study participants were very familiar with the term malaria and had good knowledge on the causes of malaria and its preventive measures. They recognized the disease mainly by the symptoms outlined in biomedical information. They described anaemia mainly by the symptoms and attributed it largely to poverty. Their knowledge on the link between malaria and anaemia was limited and this has implications for taking appropriate malaria preventive measures. This was reflected in the findings that though they knew the adverse consequences of malaria, because they did not associate it with anaemia, they did not take adequate preventive measures like using ITNs. The health education package at ANC would have to be modified to appropriately link malaria and anaemia in pregnancy to promote behavioural change in pregnant women towards malaria preventive measures. The health education packages presently are mainly at ANC and on radio. There is the need to intensify community education programmes and also target men for appropriate education.

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Chapter 4

Factors influencing the distribution of birthweights in Afigya Sekyere district

Chapter 4: Factors influencing the distribution of birthweights in Afigya Sekyere district, Ghana

Abstract

A study was undertaken in 13 health institutions in the Afigya Sekyere distict, Ashanti Region, Ghana to assess the factors influencing the distribution of birthweights from 1999 to 2003. Delivery records were examined and data from 9662 singleton live births corresponding to 91.1% of the total number of recorded deliveries during the study period were included in the analysis. The mean birthweight was 2949 g SD (±486g) with an overall LBW (<2500g) prevalence of 11.7%. The prevalence of LBW was significantly ($p<0.001$) higher among female infants than male infants. Parity was significantly ($p<0.0001$) associated with birthweight. Mean birthweight differed significantly ($p<0.0001$) between the age groups and similarly significant ($p<0.0001$) differences in mean birthweight were observed between the subdistricts. Infants delivered in the dry season were significantly ($p=0.047$) heavier (2959g ±494g, N=4803) than infants delivered in the rainy season (2940g ± 478g, N=4859). Multiple linear regression analysis identified parity, subdistrict (locality), sex of infant, maternal age and rainy season as factors significantly affecting birthweight. These findings will contribute to assessing the effect of later researches aimed at reducing the prevalence of LBW thereby improving the health and survival of infants born in the district.

Introduction

Birthweight is an important predictor of the health status of infants in terms of growth, morbidity, and survival of the newborn (WHO, 1981; Cogswell and Yip, 1995). Birthweight is influenced by many factors, the most important ones being gestational age (Bantje, 1983; Kramer, 1987; Roberts, 1976; Matsuda, 1990; Guyyat and Snow, 2004) and foetal growth rate (Bantje, 1983). Factors which affect duration of gestation and foetal growth are related to the infant, the mother and/or the physical environment. Bantje (1983) has grouped these factors into seasonal and non-seasonal factors. Maternal factors such as stature, reproductive history and socioeconomic level are classified as non-seasonal factors whereas maternal health and nutritional status are seasonal factors. The magnitude of seasonal effect on birthweight is also dependent on the geographical area.

LBW is the single most important risk factor for perinatal mortality and is also associated with increased risk of infant morbidity and mortality (Greenwood *et al.*, 1992; Phung *et al.*, 2003; Guyatt and Snow, 2004). The estimated incidence of LBW in Sub-Saharan Africa among primigravidae ranges between 5.6 and 34% (Guyatt and Snow, 2004). In Ghana, LBW level is estimated to be about 11% although a large proportion of infants are not weighed (WHO, 2004). This situation coupled with the problem of poor record keeping at most health centres could result in an underestimation of the prevalence of LBW. Ashword (1998) has noted that infants who weigh between 2000 and 2449g at birth have a four-fold higher risk of neonatal death than those who weigh between 2500 and 2999g and tenfold higher risk than those weighing between 3000 and 3499g. One of the major factors contributing to LBW in sub-Saharan Africa however, is malaria infection and about 40% of LBW in malaria endemic areas is attributed to it (Brabin and Piper, 1997; Shulman *et al*., 2001; Akum *et al*., 2005).

The implementation of initiatives that will lead to a reduction in number of LBW babies forms an important contribution to the United Nations Millennium Development Goal (MDG) for reducing child mortality (MDG 4). There is however a dearth of knowledge of basic epidemiology of factors leading to LBW in Ghana, especially in deprived communities.

The objective of this study was to describe birthweight distributions for the Afigya Sekyere district and determine factors influencing birthweight.

Materials and methods

Study area

The study was conducted in all 13 health facilities in the Afigya Sekyere district. The setting and population has been described elsewhere (chapter 2). Women in the fertile age group (15-45 years) form about 22.5% of the population, with an expected pregnancy rate of 4% (DHA, 2003). The district lies within the area of high malaria prevalence (Browne *et al.*, 2000). The major rainfall season runs from mid-March to the end of July, while the minor season begins in September and ends mid November. This period is followed by a long dry spell, which ends by mid-March. The peak of the rains occurs in May/June and October with a drier period in between in August.

Study design and data collection

The study was descriptive and was based on health data from health facilities. Details are outlined in chapter 2. In all, a total of 10,595 birth records over the five year period (1999 – 2003) were collected, entered in MS Excel and cleaned. However the analysis focused on a total of 9662 singleton live births (91.1%). Stillbirths (N=12), multiple births (N=122) and birthweight of births from women who were living outside the district (N=573) were excluded from the analysis.

Data analysis

Data was analysed using STATA version 8.0 (Stata Corp, USA). LBW (<2500g) prevalence was estimated by dividing the total number of live births with birthweight <2500g by the total number of live births in a given period and multiplying by 100. Seasonal variation in birthweight distribution was determined by averaging the monthly means over the observed years. Student's t-test was used for comparison of mean birthweights of adolescents and adult women. One way ANOVA was used to compare differences between three or more groups. Chi-square test was used to analyze proportions. Stepwise Multiple Linear Regression was used to determine factors influencing birthweight. A Generalized Linear Model (GLM) Univariate procedure was used for the comparison of birthweight among the six subdistricts and years after adjusting for differences in rainfall. $P < 0.05$ was considered as statistically significant in all the tests.

Results

Characteristics of the study population

Data on the 9662 delivery records of women who delivered singleton babies at the health facilities during the five year period were analyzed. Maternal age ranged between 12 and 48 years with a mean of 26.3; SD ± 6.9. Maternal parity ranged between 1 and 12 with 27.5 % being primipara, 22.3% were secundipara, 37.2% were parity 3-5 and 13% were parity 6 - 12.

Determinants of birthweight and LBW prevalence

The mean monthly birthweight (±SD) of singleton live births during the five years ranged from 2927g ± 0.461g (N=818) in June to 2983g ± 0.481g (N=773) in January. The overall mean birthweight was 2949 g ±486g (range 1000g and 5000g). The mean birthweight was 2995g± 500g for males (N=4885) and 2905g ± 486g for females (N=4697), the difference not being statistically significant (Pearson $\chi^2_{(1\ df)} = 1.37$; *p=0.241*). As expected, there was a significant (*p<0.0001*) difference in mean birthweight between infants of adolescent mothers (2752g ± 454g; N=1117) and adult mothers (2990g ± 485g; N=7485).

The overall prevalence of LBW for the district was 11.7% ± 1.2 with a prevalence of LBW being significantly (Pearson $\chi^2_{(1\ df)} = 13.13$; *p<0.001*) higher among females (6.5%; N=628) than in males (5.3%; N=506). There was no significant difference (*p=0.471*) in LBW between adolescent primiparae (2124g ± 288g; N= 220) and adult primiparae (2143g ± 282g; N=243).

There were significant (F value = 58.882; *p<0.0001*) differences in mean birthweight between parities (Table 4.1) and mean birthweight increased with increased parity. The largest difference in mean birthweight (+181 g) was between primi and secundiparae. The prevalence of LBW decreased from about 20% in primiparae to 8.1% in grand multipara (Table 4.1). Within the grand multipara, LBW prevalence decreased from 8.1% at parity 6 to 6.3% at parity 8. However, prevalence increased from 10.3% at parity nine to about 18.8% at parity 11 (data not shown).

Table 4.1. Influence of parity on mean birthweight and prevalence of LBW (<2500g) among singleton live births

Parity	No. of births (N)	Mean birthweight (g) (SD)	Prevalence of LBW (%)
1	2437	2767 (462)[a]	20.3
2	1978	2948 (460)[b]	11.1
3-5	3279	3020 (482)[c]	9.1
6-12	1149	3075 (512)[d]	8.1

Values in a column bearing different letters are significantly different from each other at P=0.05

Mean birth weight differed significantly (*P<0.0001*) between the age groups (Table 4.2) and mean birthweight increased with increasing age. An average difference of 222g was observed between the infants of mothers less than 20 years and mothers aged between 20 and 34 years. Mothers aged 35 years and above also gave birth to infants who were on the average 104g heavier than infants born to mothers aged between 20 and 34 years. There was a strong relationship between prevalence of LBW and age. Prevalence rate declined from 37.5 % among the infants of adolescent mothers to 6.4 % among the infants of mothers aged 35 years and above (Table 4.2).

Table 4.2. Influence of maternal age group on mean birthweight and prevalence of LBW of singleton live births

Age group (years)	No. of births (N)	Mean birthweight (g) (SD)	Prevalence of LBW (%)
<20	1118	2752 (455)[a]	37.5
20 – 24	2703	2898 (469)[b]	10.4
25 – 29	2179	3019 (473)[c]	7.2
30 – 34	1421	3051 (496)[c,d]	6.8
≥35	1184	3070 (496)[d]	6.4

Figures in parentheses are the standard deviations of the mean birthweights. Values in a column bearing different letters are significantly different from each other at P=0.05

Table 4.3 shows the mean birth weight and proportion of LBW by sub-district. Significant ($p<0.0001$) differences in mean birthweight were observed between the subdistricts. Infants delivered in the Boamang-Kwamang-Ahenkro (BKA) subdistrict had significantly ($p<0.05$) higher mean birthweight than the infants delivered in the other subdistricts. Mean birthweight did not however differ ($p>0.05$) between Agona, Wiamoase, Kona and Kyekyewere subdistricts (Table 4.3). The proportion of LBW recorded among the infants born in the district ranged from 4.8% in the Kyekyewere subdistrict to 15.8% in the Agona subdistrict (Table 4.3).

Table 4.3. Number of singleton live births, mean birthweights and prevalence of LBW in the subdistricts

Sub districts	No. of singleton live births	Mean (g) ±SD	Prevalence of low birthweight (%)
Agona	2262	2889 (518)[a]	15.8
Kona	842	2910 (478)[a]	15.0
Jamasi	1523	3004 (470)[b]	9.6
Wiamoase	2795	2900 (471)[a]	14.1
BKA	1365	3134 (467)[c]	6.2
Kyekyewere	875	2918 (429)[a]	4.8

Values in a column bearing different letters are significantly different from each other at P=0.05

The rainfall distribution in the district is bi-modal with peak rainfall months being June (230.6mm) for the major rainy season and September (199.4mm) for the minor rainy season (Fig. 4.1). There was a relationship between rainfall and mean birthweight (Fig. 4.1). Across the five years the lowest mean birthweight occurred during the peak rainfall season (June) and the highest mean birthweight was observed during the dry season. Infants delivered in the dry season were significantly *(p=0.047)* heavier (2959g ±494g, N=4803) than infants delivered in the rainy season (2940g ± 478g, N=4859).

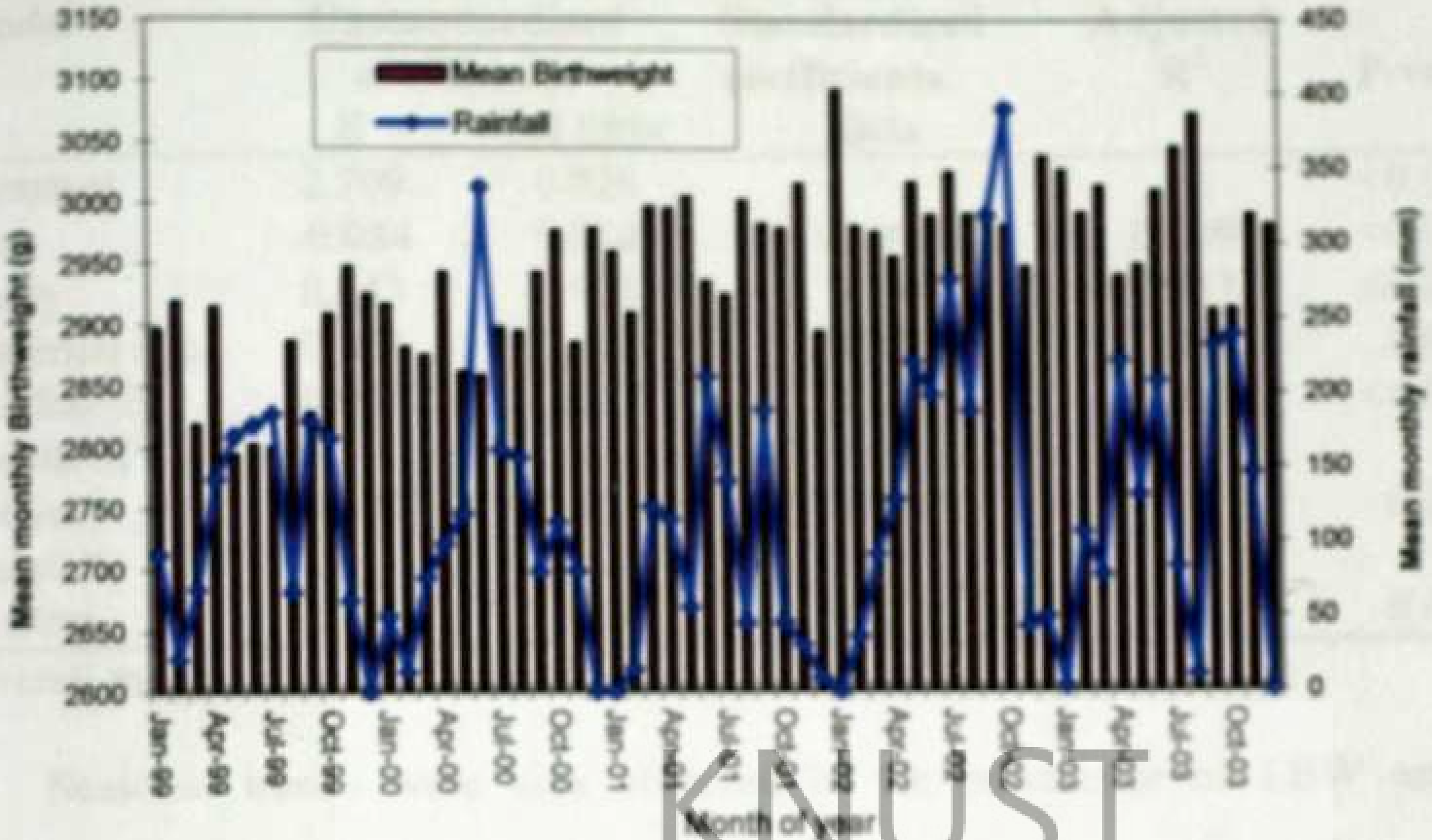

Fig. 4.1. Birthweight distribution in the Afigya Sekyere district between January 1999 and December 2003 in relation to rainfall

Multiple linear regression analysis showed that parity, subdistrict, sex of infant, maternal age and season significantly influenced birthweight (Table 4.4). Parity alone explained 5.3% of the variability in birthweight. Comparison of regressions among the subdistricts indicated a significant rainfall amount *x* subdistrict *($p<0.002$)* interaction effect on birthweight. In contrast, comparison of regressions among years showed no significant ($p = 0.240$) rainfall x year interaction effect on birthweight.

Table 4.4 Birthweight predictors in rural Afigya-Sekyere district

Model	Unstandardized coefficients		Standardized coefficients	Adjusted R^2	P-value
	B	Std Error	Beta		
Constant	2.709	0.026			*<0.0001*
Sex	-0.084	0.010	-0.093	0.009	*<0.0001*
Parity	0.043	0.003	0.194	0.053	*<0.0001*
Maternal age	0.003	0.001	0.041	0.001	*0.007*
Subdistrict	0.033	0.003	0.111	0.011	*<0.0001*
Month of delivery	0.002	0.001	0.015	-	*0.175*
Rainfall amount	0.0001	0.00001	-0.036	0.001	*0.001*

Overall model; R^2 = 0.075; N = 9662

Seasonal trends were also observed in the prevalence of LBW among both primigravidae and multigravidae (Fig. 4.2). During the period 1999 -2003, LBW prevalence was higher *(p=0.0001)* across seasons in primigravidae (20.6% ± s.d=2.1) compared to multigravidae (9.8% ± s.d= 1.3). LBW prevalence among primigravidae peaked in February (end of dry season), June (peak of major rainy season) and September (onset of the minor season rain). Similar trend was observed amongst the multigravidae (Fig. 4.3).

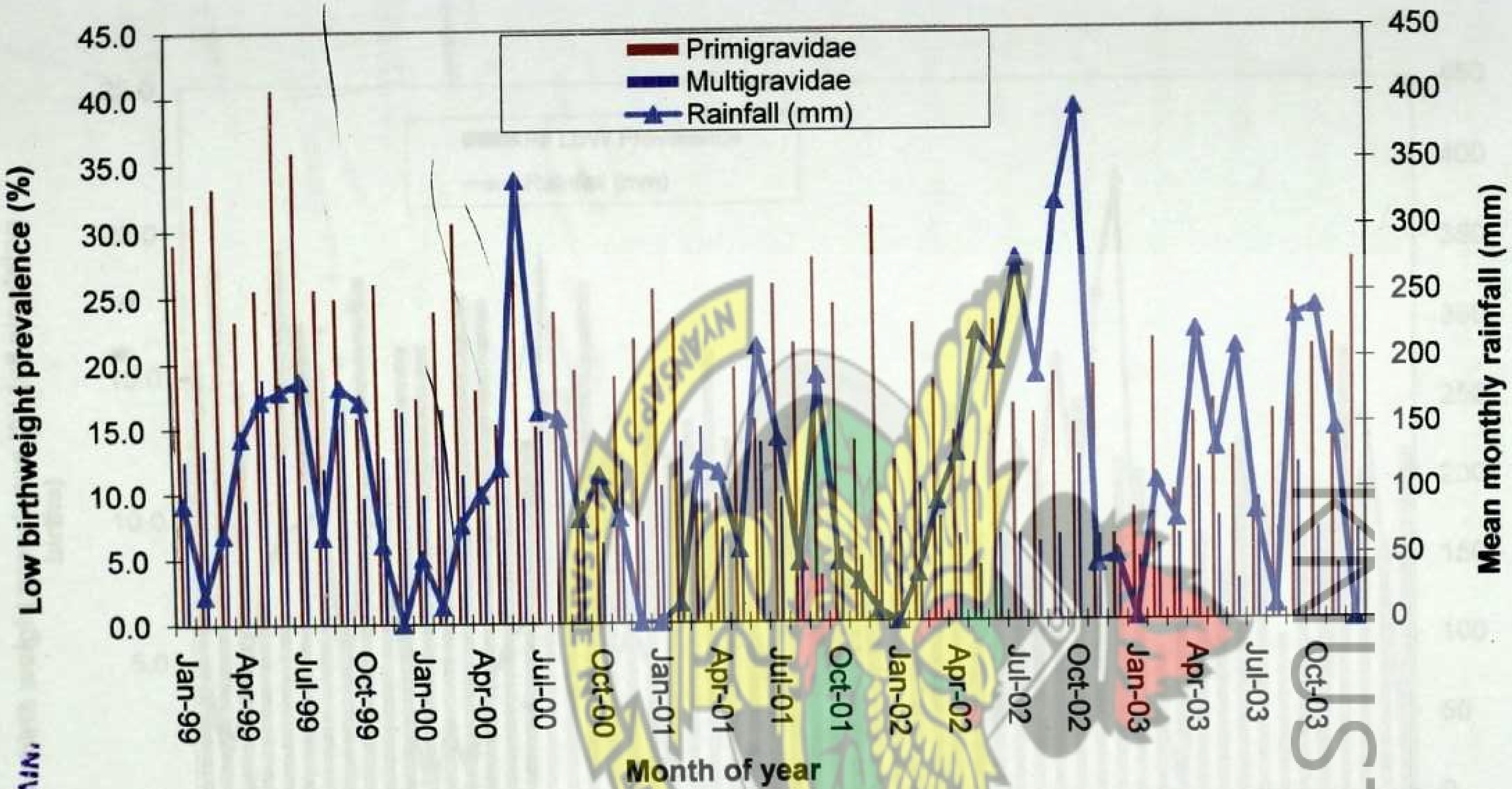

Fig. 4.2. Low birthweight prevalence of primigravidae and multigravidae in relation to rainfall between January 1999 to December 2003 in the Afigya Sekyere district of Ghana

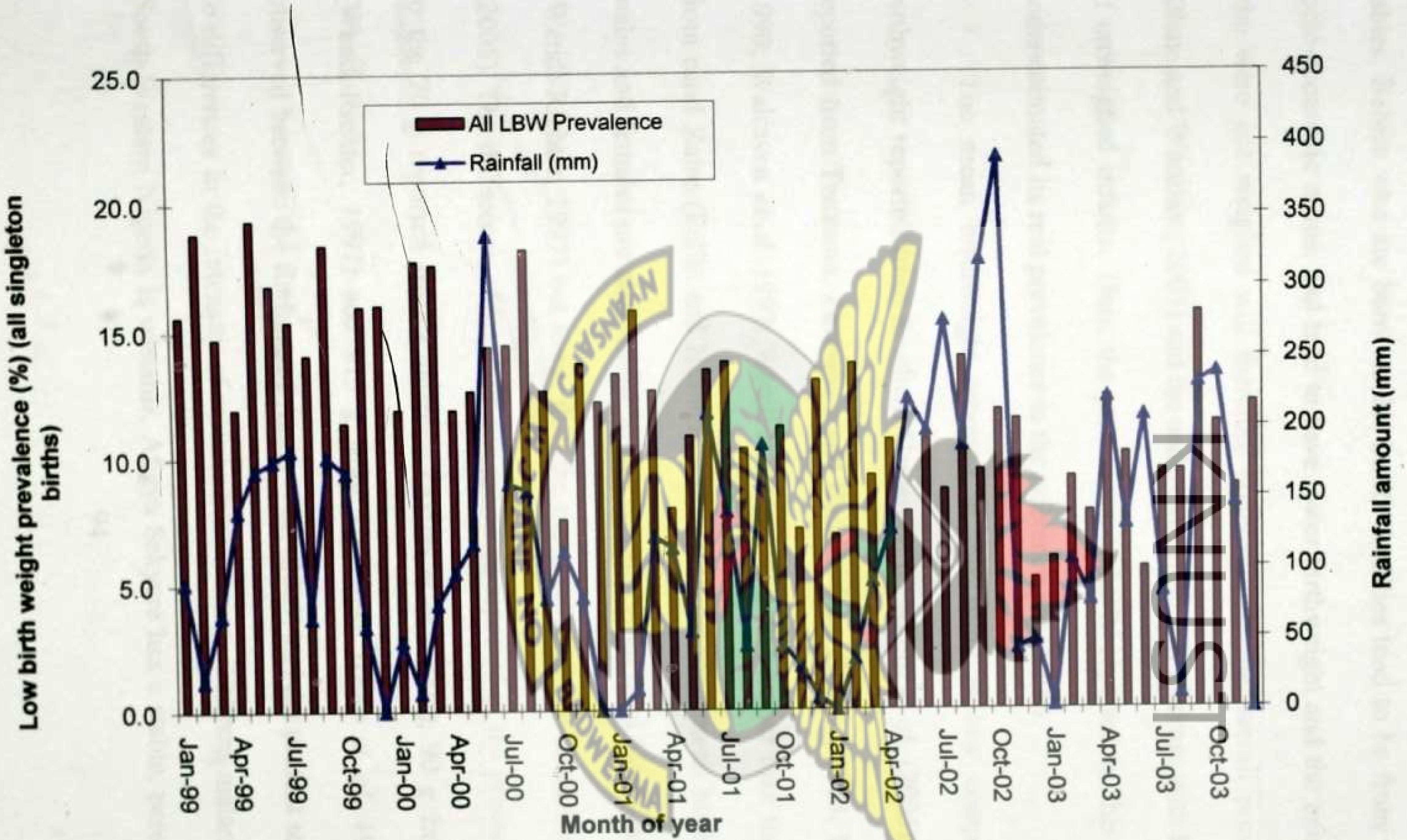

Fig. 4.3. Low birthweight prevalence of all singleton life births in relation to rainfall between January 1999 to December 2003 in the Afigya Sekyere district of Ghana

Discussions

Data on birthweights were collected from only health facilities. The Afigya Sekyere district has both trained and untrained traditional birth attendants (TBAs) who conduct about 30% of the deliveries in the district (DHA, 2002). Although the TBAs keep some records on the deliveries they conduct, they do not record the birthweights of these babies. Babies who are born outside health facilities tend to be from women of lower socio-economic status, and tend to have lower birthweight and the exclusion of infants who were not weighed will therefore underestimate the overall prevalence of LBW (Blanc and Wardlaw, 2005) and the underestimation will increase with higher proportion of unweighed infants. Thus, the prevalence of LBW reported in this study may have underestimated its real prevalence in the reference population.

The mean birthweight reported in this study is low compared with mean birthweight reported from Southern Cameroon by Akum *et al.* (2005); similar to those reported from Tanzania, Zimbabwe and Burkina Faso (Bantje, 1983, 1987; Dole *et al.*, 1990; Walraven *et al.* 1997; Wendl-Richter, 1997), but higher than the means reported from rural Zaire (Fallis and Hilditch, 1989). The reported mean birthweights for both males and females are also similar to that reported from rural North-West Burkina Faso (Wendl-Richter, 1997) but lower than the mean reported for Cameroon by Akum *et al.* (2005). The difference of 90g between the sexes reported in the present study is similar to the 70 g reported from Cameroon (Akum *et al.*, 2005), 90 g from Burkina Faso (Wendl-Richter, 1997) and 113 g from Zimbabwe (Dole *et al*, 1990). Differences observed between the findings of Akum *et al.* (2005) and the present study might be due to differences in the intensity of malaria transmission. Whereas malaria transmission in South-Western Nigeria is unstable, Afigya Sekyere has a stable, perennial and intense malaria transmission (Browne *et al.*, 2000) and may therefore account for the differences. Several authors have reported a positive correlation between parity and birthweight (Eriksson *et al.* 1997; Feleke and Enquoselassie, 1999; Andersson *et al.*, 2000; Kulmana *et al.*, 2001). In the present study, higher parity was associated with higher birthweight. A similar finding was reported from Ethiopia by Sheferaw (1990) who also observed positive effect of parity on birthweight through parity 5 and beyond. Positive correlation between parity and birthweight was also reported by Wilcox *et al.* (1996) and Juntunen *et al.* (1997). They however reported that the largest difference was between the first and second births. As expected, our findings have also shown that the largest difference was observed between the first and second. Similarly, Dhall and Bagga (1995) also reported in Northern India a significant effect of parity for the weight of the second birth but none thereafter. The reported differences in the relationships between parity and birthweight could be partly due to differences in severity of malarial infection which is gravidity-dependent, and women in their first and second pregnancies experience more severe infections than those with higher parities (Singh *et al.*, 1999). Decline in birthweight at higher parities (from parity 9 to 12) in this study may be partly attributed to maternal age. The prevalence of LBW was 20.3% in primiparae and declined to 6.3% in para 8 but increased with increasing parity (18.8% at parity 11 and above). Women in parities 1 to 8 were younger ($<20 \geq 34$ years) compared with women of parities 9 to 12 who were between ages 35 and 48. The reported higher prevalence of LBW at parity 9 and above may be partly due to anaemia since excess iron loss affects women of higher parity more severely than those of lower parities due to repeated pregnancies (Stoltzfus, 2001).

The overall prevalence of LBW of 11.7% among the singleton births we found is similar to the prevalence rates reported from various African countries; 9.3 and 14.9% both from Burkina Faso (Wendl-Richter, 1997; Blanc and Wardlaw, 2005); 11.9 and 13.4% from Togo and Niger respectively (Blanc and Wardlaw, 2005), and 14.1% from Tanzania (Bantje, 1987; Walraven *et al.*, 1997). Malaria infection could be a contributory factor to this observation since in malaria endemic areas; the infection contributes significantly to LBW (Brabin and Piper, 1997; Shulman *et al.*, 2001; Akum *et al.*, 2005). The high prevalence of 37.5% LBW observed among 1118 adolescent primiparae (<20 years) in this study is similar to the findings of Wort *et al.* (2006) who also reported prevalence rate of 42.9% in Tanzania among 507 adolescent women. The high prevalence of LBW in the adolescents may be attributed to competition for nutrients between the growing foetus and the young and still growing mothers added to the malaria induced poor transfer of nutrients across the placenta (Olson, 1987; Macleod and Kiely, 1988; Scholl *et al.*, 1990; Brabin and Brabin, 1992; Kalanda *et al.*, 2006; Wort *et al.*, 2006). Furthermore, in high malaria transmission areas, gravidity and age are risk factors and primigravidae and younger women, especially adolescents are at greater risk of malaria and its adverse effects which include delivery of LBW babies (Desai *et al.,* 2007). Anaemia as a consequence of malaria in pregnancy contributes significantly to LBW and the prevalence of anaemia has been reported to be higher in adolescent pregnant mothers than pregnant adult women (Hinderaker *et al.*, 2001; Agudelo *et al.*, 2005), which might also explain the high prevalence rate of LBW among the adolescent primiparae in the present study. Similarly, there are a number of observations that adolescent pregnancies are connected with low socio-economic status, selecting for factors that will further diminish the mother's ability to nourish the foetus (Phung *et al*., 2003; Keskinoglou *et al*., 2007).

The seasonal pattern indicating the highest mean birthweight during the dry season and lowest during the rainy season is consistent with the findings of Prentice *et al.* (1985), Fallis and Hilditch (1989), Aitken (1990), Ceesay *et al*. (1997), and Wendl-Richter (1997). Similar trend was observed for LBW distribution among primiparae and multipara. Rainy season has been associated with high incidence of malarial transmission (Bantje, 1983; Aitken, 1990; Ndyomugyenyi and Magnussen, 2001; Kobbe *et al*., 2006) as the breeding sites for mosquitoes increase during this period. Similarly, Hb concentration has been reported to show seasonal variations, with lower Hb during the rainy season (Bouvier *et al.,* 1997; Hinderaker *et al.,* 2001). Higher maternal work load and lower food intake may also be responsible for the decline in birthweight during the rainy season. Seasonal variation in mean birthweight has been associated with countries whose economies are heavily dependent on local agriculture. Seasonal differences in agricultural processes, labour requirements, food availability and malarial transmission may be marked (Bantje, 1983; 1987; Fallis and Hilditch, 1989). The higher LBW prevalence in the Afigya Sekyere district between February and June may be due to activities such as collection of trash, sowing of cereals especially maize and rice and other food crops such as cassava and plantains and field maintenance which are activities carried out by women. These activities require heavy physical work. Food availability during this period is low due to the completion of almost all plantings by April and non-poundability of cassava due to the rains. Low food intake combined with intense manual work by an expectant mother will result in fewer nutritional resources being available to the developing foetus, thereby resulting in a lower birthweight (Tafari *et al*., 1980). The variation in prevalence in LBW during the year could be explained by varying levels of agricullture related work combined with seasonal variations in malaria tranmission

Conclusion

Birthweight was influenced by parity, maternal age, subdistrict (locality), sex of infant and season. The heaviest birthweights were obtained during the dry season, whiles the lowest birthweight obtained during the rainy season. Prevalence of LBW also showed seasonality in its distribution. The relatively low mean birthweight for the area coupled with a high prevalence of LBW above the country's figure calls for the need to intensify implementation of current interventions aimed at improving the birthweight of infants and reduce the prevalence of LBW. It also indicates the need for identification of complementary strategies that will improve the impact of the current effective interventions.

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Chapter 5

Pregnancy-associated malaria and anaemia in the Afigya Sekyere district

Chapter 5: Pregnancy-associated malaria and anaemia in the Afigya Sekyere district

Abstract

In many developing countries endemic for malaria, anaemia in pregnancy is a frequent finding. Both malaria and anaemia are risk factors for increased maternal and foetal mortality, and investigation into their frequency and severity are necessary in order to adequately address them. A cross-sectional survey was done in the Afigya Sekyere district to determine the prevalence of malaria and anaemia in pregnancy and to identify the possible risk factors. Prevalence for malaria and anaemia were 19.2% and 62.8% respectively with a 2.4% prevalence of severe anaemia (Hb < 7g/dl). The main infective malaria parasite species was *P. falciparum* and the geometric mean parasite density (GMPD) was 513 parasites/µl. The identified risk factors for malaria were age and gravidity. Risk factors for anaemia were age, gravidity, malaria parasitaemia and gestational age. Younger women (adolescents), primigravidae and secundigravidae have an increased risk of both conditions. Women with malaria parasitaemia had a higher prevalence of anaemia (75.8% vs 59.6%, p=0.003; odds ratio of 2.1 (95% CI 1.3-3.5)) suggesting malaria as a major cause of the anaemia. Infection intensity was significantly higher in primigravidae compared with multigravidae (p<0.0001). Mean Hb level increased with increasing age and gravidity. Hb levels were significantly higher in the first and third trimesters than in the second trimester (p<0.0001). Efforts aimed at controlling malaria and anaemia in pregnancy in less resourceful areas should prioritize identification of younger women and those of lower parity early in pregnancy.

Introduction

The World Health Organisation indicates that out of the approximately 50 million women in malaria endemic countries who become pregnant annually, an estimated 10,000 and 200,000 of their infants die as a result of malaria infection (WHO, 2005). *Plasmodium falciparum* is the major cause of malaria and the infection increases the risk of maternal anaemia, abortion, stillbirth, prematurity, intra-uterine growth retardation (IUGR), and delivery of LBW infants (Brabin, 1983; Menendez, 1995; Steketee *et al.*, 2001). The prevalence of pregnancy-associated malaria and the clinical manifestations and complications differ in low and high transmission areas because of the varying levels of immunity (WHO, 2000). The manifestations also depend on the stage of pregnancy, previous history of malaria exposure and general maternal health and nutrition (Brabin and Rogerson, 2001). The risk of infection is highest during the second trimester and the manifestations of the disease are more pronounced in primi- and secundigravidae (WHO, 2000; Desai *et al.*, 2007). In areas with unstable transmission parasite prevalence as low as 1.8% has been reported whiles in stable transmission areas, rates range from 11.9% to 57.8% (Singh, 1999; Newman *et al.*, 2003; Geertruyden *et al.*, 2005; Coulibaly *et al.*, 2007, Kayentao *et al.*, 2007). The prevalence and intensity of infection in pregnancy is also higher in women infected with the human immunodeficiency virus (Warrell and Gilles, 2002).

In malaria endemic areas a high incidence of anaemia in pregnancy especially in primgravidae has been reported and linked with malaria (Mutabingwa, 1994; Ndyomugyenyi and Magnussen, 1999; Savage *et al.*, 2007) though other causes and risk factors have also been reported. These other factors include helminthic infections, poor nutrition, HIV/AIDS, haemoglobinopathies, sociodemographic factors (age, level of formal education) and obstetric factors like parity (WHO, 1992; Kagu *et al.*, 2007; Savage *et al.*, 2007). Steketee *et al.* (2001) observed that in malaria endemic areas, 3–15 % of anaemia in pregnancy is due to malaria.

It is estimated that the prevalence of anaemia in pregnancy is 56% in developing countries. In Africa, prevalence of anaemia ranges between 35% in the southern and 56% in western Africa (WHO, 1992; Stoltzfus, 2001). Maternal anaemia reduces the productivity of the individual and has adverse effects on pregnancy outcome (Stoltzfus, 1997; Brabin *et al.*, 2001). The effects include increased risk of maternal and foetal morbidity and mortality, preterm delivery and low birthweight. Brabin *et al.* (2001) found that anaemia was an important contributor to maternal mortality with relative risks of 1.35 from moderate anaemia and 3.51 from severe anaemia.

Prior to the intervention study aimed at controlling malaria in pregnancy, a baseline study was undertaken with the objective of describing the prevalence of malaria and anaemia in pregnancy and to elucidate the risk factors associated with anaemia in pregnancy in the Afigya Sekyere district.

Materials and Methods

Study area and population

The setting and population of the district has been described in detail in chapter 2. Women in the fertile age group (15-45 years) form about 22.5% of the population, with an expected pregnancy rate of 4% (DHA, 2007). The district lies within the area of stable, perennial and intense malaria transmission (Browne *et al.*, 2000). It has a bimodal rainfall pattern with annual rainfall between 1500 and 2000mm. The major rainy season runs from March to the end of July, while the minor rainy season begins in September and ends in November. The common health problems suffered by pregnant women are malaria, anaemia and abdominal problems.

Study design and methods

A cross-sectional study was done in March and September 2005 involving 506 pregnant women who were examined for malaria parasitaemia and Hb level. The study took place at both health facilities and in communities. The women were informed about the purpose of the study and verbal consent was sought from them. Women who gave their consent were included in the survey. Information on age and parity were obtained and gestational age was estimated from date of last menstrual period as recorded in the antenatal care card. Hb concentrations were determined using a HemoCue® photometer (HemoCue, Ängelholm, Sweden). Blood samples were taken from finger pricks for preparation of thick and thin smears by a medical laboratory technician and two laboratory assistants. The slides were transported to KNUST where they were stained with 10% Giemsa solution and examined by light microscopy using an oil immersion objective x 100. Parasitaemia was determined per microlitre (µl) of blood by counting the number of asexual parasites per 200 white blood cells, assuming 8000 leukocytes/µl, and multiplying the parasite count by 40. A slide was considered negative if no parasites were observed within 200 high power fields. Ten percent of the slides were randomly selected and examined by another technician for quality control purposes.

Data analysis

Data was entered in Microsoft Access and imported into SPSS® for Windows® version 16.0 (SPSS Inc. 2007, USA) for analysis. Parasitaemia was categorized into three levels as low (<1000/μl), high (1000 – 10000/μl) and very high (>10000/μl). Geometric means were calculated for parasite densities. Anaemia was categorized into mild anaemia (Hb 90 - 109g/l), moderate anaemia (Hb 70 - 89g/l)) and severe anaemia (Hb < 70g/l). Descriptive statistics were computed for all relevant variables, with percentages for categorical variables and means for continuous variables. Proportions of categorical variables were compared using Chi-square test. For comparison of means of two groups, student t-test was used and for comparison of three or more groups one-way ANOVA or Kruskal-Wallis was used. Logistic regression was done to determine the relationship between gravidity, age, gestation and parasiatemia and anaemia. In calculating odds ratios, primigravidae, adolescence and first trimester were fixed. A probability of $p<0.05$ was considered significant for all tests.

Ethical considerations

Approval for the study was obtained from the Afigya Sekyere District Health Management Team (DHMT). It was also approved by the Committee on Human Research Publication and Ethics of the School of Medical Sciences, KNUST, Ghana and the Danish National Committee for Biomedical Research Ethics. Informed consent was obtained from the study participants.

Results

Background characteristics of participants

Five hundred and six women participated in the survey but the analysis focused on 496 (98%) of them due to incomplete information on 10 women. Table 5.1 shows Hb levels, parasitaemia prevalence and infection density in relation to age, parity and gestational age at examination. The age of participants ranged from 14 to 45 years with a mean of 26.2 years.

Table 5.1. Mean haemoglobin (Hb) and parasite density (GMPD) by age, parity and gestational age

Background variable	N (%)	Mean Hb (g/l) (SD)	GMPD/µl
Gravidity	n= 496		
Primigravidae	135 (27.2)	100.6 (15.1)	1248
Secundigravidae	96 (19.4)	103.5 (16.1)	560
Multigravidae (3-5)	206 (41.5)	105.9 (15.4)	177
Grandmultigravidae (≥ 6)	59 (11.9)	108.4 (12.0)	139
P-value		*0.002*	*0.3*
Age group	n=495		
<20	59 (11.9)	100.3 (15.2)	1744
20-34	381 (77)	104.4 (15.3)	421
>34	55 (11.1)	107.7 (14.9)	153
P-value		*0.03*	*0.3*
Trimester at which woman was seen	n=456		
First	68 (14.9)	110.5 (18.5)	341
Second	192 (42.1)	101.1 (14.8)	578
Third	196 (43)	105.1 (14.1)	460
P-value		*<0.0001*	*0.4*

Prevalence of malaria parasitaemia

Prevalence of malaria parasitaemia was 19.2% and the geometric mean parasite density (GMPD) was 513 parasites/µl. The GMPD in relation to gravida, age and gestational age is as shown in Table 5.1. The infections were principally due to *P. falciparum* and only three women had mixed infections of *P. falciparum* and *P. malariae*. Among parasitaemic women, 61.1% had parasite counts below 1000/µl, 30.5% had between 1000 to 10000 parasites/µl and 8.4% had >10000 parasites/µl. Prevalence of parasitaemia was associated with gravidity and age (Table 5.2). Parasitaemia rate was 13.2% in the first trimester, 25.0% in the second trimester and 17.9% in the third trimester though the differences were not significant. The difference in the proportion of parasitaemic women with anaemia (75.8% = 72/95) compared to aparasitaemic women with anaemia (59.6% = 238/399) was statistically significant (p=0.003) with an odds ratio of 2.1 (95% CI 1.3-3.5). As parity increased, prevalence of parasitaemia also decreased. The prevalence of parasitaemia was higher (OR 0.60; 95% CI 0.32 – 1.12) in primigravidae compared to secundigravidae and grandmultigravidae (OR 0.26; 95% CI 0.10 – 0.65) (Table 5.2). Malaria parasitaemia in pregnant adolescents (<20 years) was higher than in older pregnant women (Table 5.2). Anaemia prevalence in primigravidae compared to secundigravidae and multigravidae was not significantly different (Table 5.3). The adolescents (<20 years) had higher prevalence of anaemia compared to the adult pregnant women.

Table 5.2. Relationship between prevalence of parasitaemia and gravidity, age group and trimester

Variable	Parasitaemia Yes	No	OR*	95%CI
Gravidity				
Primigravidae	41 (30.4)	94 (69.6)	-	-
Secundigravidae	20 (20.8)	76 (79.2)	0.60	0.32 – 1.12
Multigravidae (3-5)	28 (13.6)	178 (86.4)	0.36	0.21 – 0.62
Grandmultigravidae (≥6)	6 (10.2)	53 (89.8)	0.26	0.10 – 0.65
Trimester				
First	9 (13.2)	59 (86.8)	-	-
Second	48 (25)	144 (75)	2.19	1.01 – 4.74
Third	35 (17.9)	160 (82.1)	1.43	0.65 – 3.16
Age group				
<20	20 (33.9)	39 (66.1)	-	-
20-34	66 (17.3)	315 (82.7)	0.41	0.22 – 0.75
>34	9 (16.4)	46 (83.6)	0.38	0.16 – 0.93

Figures in parentheses under **Yes** *and* **No** *are percentages*
* = Odds ratio; 95% CI = 95% Confidence Interval

Table 5.3. Prevalence of anaemia by gravidity, age group and trimester

Variable	Anaemia Yes	No	OR*	95%CI
Gravidity				
Primigravidae	98 (73.1)	36 (26.9)	-	-
Secundigravidae	60 (62.5)	36 (37.5)	4.54	2.59 – 7.97
Multigravidae (3-5)	123 (59.7)	83 (40.3)	1.84	1.15 – 2.95
Grandmultigravidae (≥6)	29 (50.0)	29 (50.0)	0.37	0.19 – 0.70
Trimester				
First	32 (47.1)	36 (52.9)	-	-
Second	135 (70.7)	56 (29.3)	0.37	0.21 – 0.65
Third	118(60.8)	76(39.2)	0.57	0.33 – 1.00
Age group				
<20	46 (78)	13 (22)	-	-
20-34	237 (62.5)	142 (37.5)	0.17	0.09 – 0.32
>34	26 (47.3)	29 (52.7)	0.25	0.11 – 0.57

Figures in parentheses under **Yes** *and* **No** *are percentages;*
* = Odds ratio; 95% CI = 95% Confidence Interval

Haemoglobin levels and prevalence of anaemia

The mean Hb was 104.3 (±15.3) g/l with a range from 50 g/l to 162 g/l. Hb increased significantly with increasing gravidity (p=0.002) and age (p=0.03) (Table 5.1). Hb was significantly lower among primigravidae compared to multigravidae (p=0.02) and grand multigravidae (p=0.004). Mean Hb in relation to age showed significant (p=0.03) difference only between adolescents and those aged 35years and above (Table 5.1). Generally, haemoglobin levels declined with increasing gestation in the second trimester and increased thereafter (Table 5.1). Significant differences in mean Hb was observed between the trimesters. The highest mean difference was observed between the first and second trimester (p<0.0001). There was a 62.8% (310/494) prevalence of anaemia (Hb < 110g/l) and 2.4% (12/494) severe anaemia (Hb <70g/l). Table 5.3 shows the distribution of the women who were anaemic in relation to their gravidity, age and the trimester at which the women presented for the study. Prevalence of anaemia was statistically significant for age, gravidity and gestational age. Prevalence of anaemia decreased with increasing gravidity from 73.1% in primigravidae to 50.0 % in grandmultigravidae (Table 5.3). Similarly, anaemia prevalence decreased with increasing age from 78% in adolescents to 47.3% in those aged 35 years and above. Relationship between anaemia and age and being parasitaemic was significant ($\chi^2_{(2\,d.f.)}$= 7.02; p= 0.03). Ninety percent of the parasitaemic adolescents were anaemic compared with 44.4% of parasitaemic women above 34 years. The effect of each associated risk factor was examined for severity of anaemia (Table 5.4). The results showed that severity was significantly (p =0.02) related to gravidity.

Table 5.4. Relationship between severity of anaemia, parasitaemia, age, gravidity and gestational age

Variable	Normal Hb	Mild anaemia (90≤109g/l)	Moderate anaemia (Hb 70≤89g/l)	Severe anaemia (Hb <70g/l)	*p*-value
Parasite prevalence					
Parasite positive	23 (24.2)	46 (48.4)	22 (23.2)	4 (4.2)	0.09
Parasite negative	161 (40.4)	183 (76.9)	47 (19.7)	8 (3.4)	
Gravidity					0.02
Primigravidae	36 (26.9)	66 (49.2)	28 (20.9)	4 (3.0)	
Secundigravidae	36 (37.5)	41 (42.7)	15 (15.6)	4 (4.2)	
Multigravidae (3-5)	83 (40.3)	98 (47.6)	21 (10.2)	4 (1.9)	
Grandmultigravidae (≥6)	29 (50)	24 (41.4)	5 (8.6)	0	
Total	184	229	69	12	
Age (yrs)					0.37
<20	13 (22.0)	29 (49.1)	16 (27.1)	1 (1.7)	
20- 34	142 (37.5)	180 (47.5)	47 (12.4)	10 (2.6)	
> 34	29 (52.7)	19 (34.5)	6 (10.9)	1 (1.8)	
Total	184	228	69	12	
Trimester					0.1
First	36 (52.9)	28 (41.2)	2 (2.9)	2 (2.9)	
Second	56 (29.3)	92 (48.2)	37(19.4)	6 (3.1)	
Third	76 (39.2)	89 (45.8)	26 (13.4)	3 (1.5)	
Total	168	209	65	11	

Figures in paranthesis are percentages

Discussions

The overall prevalence of malaria parasitaemia among the pregnant women was 19.2% whereas prevalence of anaemia and severe anaemia was 62.8% and 2.4% respectively. The predominant malaria parasite species identified was *Plasmodium falciparum*. The study identified age and parity as risk factors for parasitaemia in pregnancy and also for intensity of infection. It also identified age, parity, parasitaemia and gestational age as risk factors for anaemia in pregnancy. Primigravidae and adolescents were at a higher risk of parasitaemia with higher parasite counts than multigravidae and adults. Risk factors previously identified for malaria in pregnancy include age and parity, with women of lower parity experiencing more intense infection than those with higher parities (Brabin, 1983; WHO, 2000; Desai *et al.*, 2007). The parasite prevalence of 19.2% is comparable to the prevalence from studies in other endemic areas with comparable levels of malaria transmission (Desai *et al.*, 2007; Coulibaly *et al.*, 2007). The parasite prevalence in this study decreased with increasing gravidity similar to what was observed by Nnaji *et al.* (2006) in Nigeria where the parasitaemia prevalence was 87.9% in primigravidae, 81.4% in secundigravidae and further decreased at higher gravidity. This observation is because in contrast to a non-pregnant woman, specific *P. falciparum* species with preference for adhesion to chondroitin sulphate A (CSA) sequestrate in the placenta of pregnant women making the primigravidae more susceptible to the infection. Following repeated pregnancies, women develop specific antibodies against CSA binding parasite species which accounts for the lower risk of infection and parasite intensity in the multigravidae compared to primigravidae (Fried, 2001; Guitard, 2008). Significant differences in parasite rates and infection intensity were observed in the present study between adults and adolescents. Similar finding was reported in Tanzania by Wort *et al.* (2006) who reported higher parasite prevalence in adolescent primigravidae than adult primigravidae (41.3% versus 31.5%; p=0.007). They also observed that parasite prevalence significantly decreased with increasing age in adolescent primigravidae. These observations could be because (i) adolescents have not developed enough immunity that comes with age and or (ii) adolescents are mainly primigravidae and hence have not developed the acquired immunity as a result of previous pregnancy exposure. The observed increased parasite prevalence in the second trimester is consistent with observations from review of studies in endemic areas that parasite prevalence peaks in mid-pregnancy (Brabin & Rogestion, 2001). The difference in parasite prevalence at different gestational ages may be attributed to regained immunity of the pregnant woman in the later stage of pregnancy when the woman regains her ability to contain and remove parasites.

The prevalence of anaemia of 62.8% is similar to findings from other areas with comparable levels of malaria transmission (Desai *et al.* 2007; Coulibaly *et al.* 2007). Some previous studies have identified age, parity and malaria parasitaemia as risk factors for anaemia in pregnancy (Verhoeff *et al.*, 1999; Achidi *et al.*, 2005; Savage *et al.*, 2007) in stable malaria transmission areas. The present study observed a pattern of variation in Hb concentration by gestational age similar to patterns found by Verhoeff *et al.* (1999) where the Hb levels decreased during the second trimester and starts increasing again from the end of the second trimester through the third trimester. This variation is partly attributed to haemodilution which occurs during mid-pregnancy due to increased plasma volume. This may also be partly attributed to malaria. In the present study, parasitaemia as well as parasite density were significantly associated with prevalence of anaemia as more parasitaemic women were anaemic compared to the aparasitaemic women, suggesting malaria as an important cause of the anaemia. Parasitaemia peaks between 9 and 16 weeks of gestation (Brabin, 1983; WHO, 2000) and maternal anaemia has been observed to peak shortly after this period (Gilles *et al.*, 1969). Though 59.6% of the anaemic women were aparasitaemic, malaria could not be ruled out as a contributor to the anaemia because in stable malaria transmission areas, there is early resolution with the frequent malaria attacks and most women are asymptomatic. Peripheral parasitaemia may be low or absent but placental parasitaemia may persist thereby causing anaemia. Infected erythrocytes have also been observed to accumulate in the maternal vasculature of the placenta to much higher densities than in the peripheral circulation (Rogerson *et al.*, 2007a; Rogerson *et al.*, 2007b; Guitard *et al.*, 2008). Adolescents were at a higher risk of anaemia and the study found 78% of them to be anaemic. This observation may be attributed to competition for nutrients between the growing foetus and the adolescents who are still in the growth stage (Olson, 1987; Brabin and Brabin, 1992). It was observed in the present study that malaria is also a contributor to anaemia because as high as 90% (data not shown) of the parasitaemic adolescents were anaemic. Similarly, 75% of the women aged between 20 and 34 years who were parasitaemic were also anaemic. Agyepong *et al.* (1997) also reported anaemia prevalence of 79% among adolescents in a farming community in southern Ghana. It has been observed that in high transmission areas, age and gravidity are risk factors and primigravidae and younger women, especially adolescents have a higher risk of malaria (Wort *et al.*, 2006; Desai *et al.* 2007). These findings are however in contrast with the finding of Adam *et al.* (2005) who found in eastern Sudan that age and parity were not significantly associated with anaemia. This may be due to differences in transmission levels and women of all parities in low and unstable transmission areas are affected equally (Fleming, 1989; WHO, 2000). Primigravidae had an increased risk of anaemia compared with multigravidae and this lends support to findings by Savage *et al.* (2007) who attributed the excess risk of anaemia in primigravidae compared with multigravidae to malaria.

A limitation of the present study was that reliable data was not available on use of antimalarials by the participants and information was not taken on other anaemia risk factors like nutritional status hence results can only be interpreted as estimates of the influence of the identified risk factors of anaemia.

Conclusions

Malaria infection and anaemia in pregnancy are common in the Afigya Sekyere district and comparable with prevalence from other malaria endemic areas in sub-Saharan Africa. The study has demonstrated that age and parity are risk factors for malaria in pregnancy and younger women, primigravidae and secundigravidae have an increased risk of infection compared with multigravidae. The findings are consistent with findings from other malaria endemic areas where age, gravidity, malaria and gestational age are major factors that influence the haemoglobin status of pregnant women. Adolescents and primigravidae have an excess risk of developing anaemia compared to their older counterparts. The excess risk in these categories of pregnant women can be used to monitor malaria control in pregnancy by targeting interventions towards these groups in areas where resources are limited. Processes that will facilitate early identification of adolescents and primigravidae is recommended since adolescents have been observed to have the tendency of not accessing health care early in pregnancy which contributes to their increased risk of adverse obstetric outcomes.

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Chapter 6

Reducing adverse effects of pregnancy-associated malaria with intermittent preventive treatment: contribution of community health agents

Chapter 6: Reducing adverse effects of pregnancy-associated malaria with intermittent preventive treatment: contribution of community health agents

Abstract

Intermittent preventive treatment (IPTp) of malaria in pregnancy with sulphadoxine-pyrimethamine (SP) has been delivered through formal health facilities with beneficial effects on peripheral and placental parasitaemia, anaemia, and birthweight. We tested the possibility of using recognized community health agents in administering IPTp in deprived communities in order to increase IPTp coverage. IPTp given through community agents reduced the prevalence of maternal peripheral parasitaemia, anaemia and increased birthweight. Parasitaemia prevalence declined from 25.5% at recruitment to 10.2% after two doses of SP. There was no significant difference in parasitaemia prevalence between the health facility intervention (HFI) and the community-based intervention (CBI) at recruitment (p=0.26), after SP dose 1 (p=0.5) or after SP dose 2 (p=0.27). Gravidity and age did not influence maternal peripheral parasitaemia between the HFI and CBI groups. Anaemia reduced from 69.3% at recruitment for primigravidae to 44.1% after the intervention. Except for recruitment, anaemia prevalence was not different between HFI and CBI among primigravidae. Mean birthweight was significantly (p=0.04) higher for CBI than HFI. The overall prevalence of LBW was 4.9%. LBW was higher in the CBI (7.3%) than in the HFI (2.8%). Compliance was significantly (p<0.001) higher in CBI compared to HFI. With provision of adequate resources, supervision and monitoring, community health agents were able to deliver IPTp. It is recommended that where accessibility to quality health care in pregnancy is limited, especially in terms of transport and infrastructure, recognized community health agents who have links with the formal health system can be trained and used for malaria

control. With regular supervision, monitoring and some minimal financial motivation, set goals can be achieved.

Introduction

Pregnancy-associated malaria poses a threat to the health of the woman and her foetus and is reflected as asymptomatic parasitaemia, acute febrile illness; anaemia, low birthweight (LBW) and increased infant mortality (Breman, 2001). Preventive measures being implemented in malaria endemic countries to reduce the high morbidity and adverse effects on birth outcomes are the use of insecticide treated bednets (ITNs) and intermittent preventive treatment with sulphadoxine pyrimethamine (IPTp). Due to its efficacy, most endemic African countries where it is suitable have adopted the strategy of IPTp (WHO, 2006). Shulman *et al.* (1999) and Rogerson *et al.* (2000) have all reported high protective efficacy of this intervention against parasitaemia and anaemia especially in primi and secundigravidae.

The Ghana National Malaria Control Programme (NMCP) also adopted the WHO recommendation of IPTp when significant levels of chloroquine resistance were reported in the country (GHS/NMCP, 2005). IPTp is delivered as a component of ANC at the health facilities. However, there are many pregnant women in remote and inaccessible areas and others constrained by financial and cultural barriers that do not attend ANC regularly. Some also do not begin ANC attendance early when the effect of malaria is more pronounced on pregnancy (Desai *et al.,* 2007). Community health workers have successfully been used in malaria control programmes (Greenwood *et al.,* 1989; Delacollette *et al.,* 1996; Kidane and Morrow, 2000). Kidane and Morrow (2000) explored the advantage of closeness to the community and developed a malaria worker network of mother co-ordinators who provided antimalarials and gave health education to households. Delacollette *et al.* (1996) also recruited, trained and used community health workers for malaria treatment and reported appreciable levels of reduced malaria morbidity and changes in health care behavior, though malaria-specific mortality rates remained the same. Greenwood *et al.* (1989) used traditional birth attendants (TBA) in the administration of malaria chemoprophylaxis and reported a positive effect on the outcome of pregnancy. Mbonye *et al.* (2008) also used a community-based delivery approach of IPTp and compared it with IPTp delivered at health units and reported a lower prevalence of LBW in the community based approach (8.3% at health units and 6.0% with the community-based approaches). In the Afigya Sekyere district, many roads are not motorable, making accessibility to some communities difficult for delivery of quality health care, especially during the rainy season. The present study was therefore designed to explore the possibility of using recognized community health agents in administering IPTp to pregnant women in rural and deprived communities and assess the effect on birthweight, anaemia and parasitaemia. Primigravidae and secundigravidae were chosen for the study since they experience more intense infections and the manifestations of the disease are more pronounced in them (Desai *et al.*, 2007).

Materials and methods

Study area and population

Details of the Afigya Sekyere district have been given in Chapter 2. In brief the district covers an area of 780 Km^2. There are a few tarred roads and most roads are small gravel feeder roads and accessibility to the hinterland is very difficult during the rainy season

(DPU 2005, DHA, 2005). Coupled with the problem of inadequate transport for outreach services is a major challenge of inadequate staff. The district however has a large number of community health agents which include trained 52 traditional birth attendants (TBAs), 132 community-based surveillance volunteers (CBSVs) and 41 chemical sellers (DHA, 2007). The TBAs conduct about 30% of deliveries in the district (DHA, 2002). The area has perennial and intense malaria transmission and malaria accounts for an average of 67.5% of outpatient cases and more than 62% of hospital admissions annually. Women in the reproductive age group form about 22.5% of the population and the expected pregnancy rate is 4% (DHA, 2005; DHA, 2007). The uptake of ANC services is about 69.6% and 59.5% of deliveries are supervised (DHA, 2007), indicating that a large number of pregnant women are not accessing ANC and delivery services at the formal health facilities.

Study design

The study was conducted in the six subdistricts of Afigya Sekyere. Thirty-five community health agents which included 18 trained TBAs and 17 CBSVs were selected with the help of the District Health Administration. They were selected from communities without health facilities but who regularly reported on deliveries from their communities. Two field workers (FWs) were permanently employed for the study to supervise and monitor activities of the community agents. Six health facilities, one from each sub district were also selected as study sites. Data was collected from October 2005 to September 2007.

Training, recruitment and intervention

Details of the methods used have been given in chapter 2. In brief a three-day training session focusing on malaria in pregnancy was organised for FWs and the selected trained TBAs and CBSVs. A one-day training session was also held for midwives from all the health facilities in the district. Community sensitization on malaria and IPTp was done. Primigravidae and secundigravidae who gave their consent were enrolled in either the HFI or CBI study arm. A unique identity number was given to each study participant and was recorded on ANC cards. The participants received a single-dose sulphadoxine-pyrimethamine (1500/75mg) with daily iron and folate supplementation at least one month apart beginning from 16 weeks gestation. Monthly and quarterly meetings were held with facility and community personnel who implemented the IPTp as DOT.

Delivery procedures

The TBAs and CBSVs were given baby scales (UNICEF Super Samson Salter) to record birthweights measuring to the nearest 50g. They were also provided with containers to keep the placenta, slides and slide boxes for storing blood and placenta slides. All the babies delivered at the health facilities and by TBAs were weighed within 7 days of delivery.

Laboratory procedures

Details on laboratory procedures have been given in chapter 2. Midwives, CBI teams, FWs and laboratory technicians had adequate and regular supply of slides, slide boxes, lancets, microcuvettes, gloves, cotton wool and methanol to prepare and store blood slides. All blood slides from the health facilities, TBAs, CBSVs and laboratory technicians were collected by the FWs and transported to KNUST for processing. The slides were stained with Giemsa and examined by light microscopy and parasitaemia was determined per µl of blood. Ten percent of the slides were randomly selected and examined by another technician for quality control purposes. Haemoglobin (Hb) concentrations were determined using a HemoCue® photometer (HemoCue, Ängelholm, Sweden). Placenta blood slides were prepared after delivery from the maternal surface of the placenta. The research team and FWs visited field sites to provide technical support.

Sample size calculations

A mean difference of 150g in birthweight was estimated between the CBI and HFI groups and this was used in calculating a sample size of 175 per study arm at a power of 80%, at significance level of 0.05 and an assumed standard deviation of 500g. With an estimated 20% loss to follow-up, a total of 420 were needed for the study.

Data processing and analysis

Data was recorded into notebooks and entered into Microsoft Access database. Analysis was based on the endpoints of the study using SPSS® for Windows® version 16.0. (SPSS Inc. 2007, USA). Geometric means were calculated for parasite densities. Anaemia was categorized into mild anaemia (Hb 70≤109g/l) and severe anaemia (Hb < 70g/l). LBW was defined as <2500g. Proportions of peripheral parasiatemia, anaemia and LBW were computed and compared using Chi-square test. A probability of $p<0.05$ was considered significant for all tests.

Ethical considerations

Ethical approval for the study was obtained from the Committee on Human Research Publications and Ethics of the School of Medical Sciences, KNUST, Ghana and the

Danish National Committee for Biomedical Research Ethics. Administrative approval was obtained from the Afigya Sekyere District Health Management Team (DHMT), Ghana Health Service, Agona, Ghana. All heads of health institutions in the district were formally informed on the study by the District Director of Health Services and sensitization meetings were held with midwives and recognized community health agents and their consent and co-operation solicited. Written consent was obtained from eligible women after detailed explanation of the aims and process of the study. Participants either signed or thumb-printed a consent form.

Results

A total of 515 women were screened and 451 were recruited into the study. Reasons for exclusion of 64 of the women are shown in Fig. 6.1. Two hundred and thirty (230) were recruited at the health facility and 221 by the community health agents. Two women voluntarily withdrew from the study without giving any reason. There were three reported miscarriages and loss to follow-up was 36 for HFI and 34 for CBI. Reasons for the loss to follow up were migration from the study district especially among women in the CBI group after some of them had taken the three doses of SP and the inability of field staff to trace the houses of those recruited at the health facilities due to no house numbers or unreliable house numbers provided by the women. Those without birthweights were women seen more than a week after delivery.

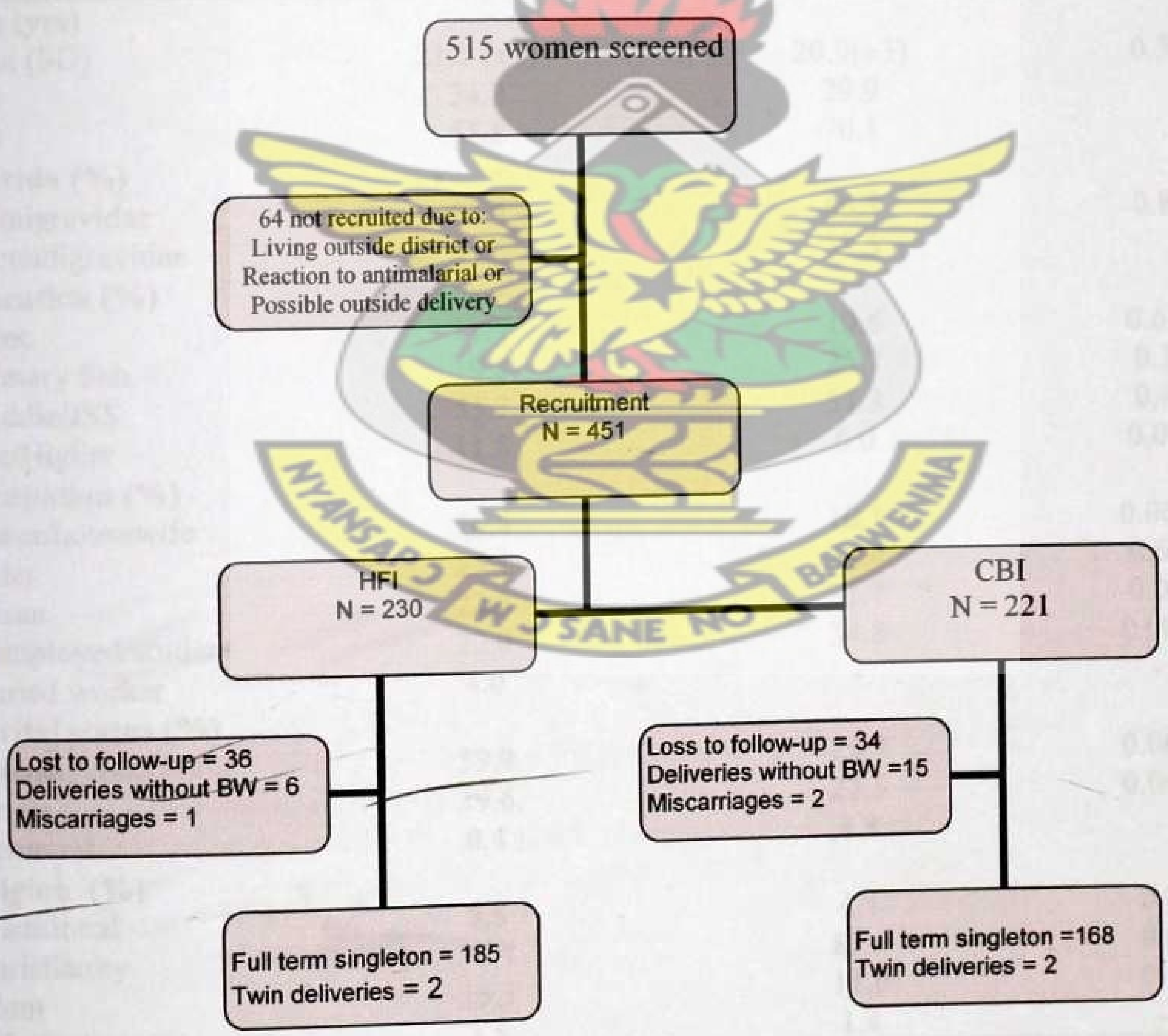

Fig. 6.1. Trial Profile of IPTp in Afigya Sekyere District, Ghana

The participants in the two intervention groups were comparable with regards to most of the background characteristics with the exception of marital status, occupation and attainment of secondary/higher education (Table 6.1). Maternal age ranged from 14 years to 35 years with a mean of 21.1 (±3) years. Mean age for primigravidae was 20 (±3) years whereas that for secundigravidae was 23.1 (±3) years. There were 141 (31.8%) adolescents (<20 years) and 303 (68.2%) adults (≥20 years). Primigravidae and secundigravidae accounted for 65.9% and 34.1% respectively of the study population. Overall mean gestational age at recruitment was 19.9 (±3.7) weeks. The proportion of women who indicated use of ITNs was 19.6%.

Table 6.1. Background characteristics of study participants

Variable	Proportion with HFI n = 230	Proportion with CBI n = 221	*p*-value
Age (yrs)			
Mean (SD)	21.2 (±4)	20.9(±3)	0.3
< 20	34.2	29.9	
≥ 20	65.8	70.1	
Gravida (%)			
Primigravidae	65.4	66.5	0.8
Secundigravidae	34.6	33.5	
Education (%)			
None	11.9	10.6	0.65
Primary Sch.	19.8	25.7	0.1
Middle/JSS	53.7	57.3	0.4
Sec/Higher	11.5	6.0	0.04
Occupation (%)			
Farmer/housewife	26.4	10.1	0.001
Trader	25.1	23.4	0.67
Artisan	22.5	31.7	0.03
Unemployed/student	22.0	34.8	0.003
Salaried worker	4.0	-	-
Marital status (%)			
Married/cohabiting	59.9	75.7	0.001
Single	39.6	22.5	0.001
Divorced	0.4	1.8	-
Religion (%)			
Traditional	3.5	4.1	0.7
Christianity	76.7	83.5	0.07
Islam	16.3	11.0	0.1
Other religions	3.5	1.4	-

JSS – Junior Secondary School

Compliance with IPT

The mean gestational age at first dose for all women was 20.3 (±3.2) weeks. Overall compliance with two doses was 78% and that for three doses was 56.3%. Differences in compliance with two doses between HFI (67.5%) and CBI (89.1%) was significant (p<0.001). Similarly, differences between HFI (44.2%) and CBI (69.1%) in compliance with three doses was significant (p<0.001) (Table 6.2). Overall, the proportion of primigravidae who complied with three doses was 55.2% and secundigravidae was 58.4%. Compliance rates were significantly higher in the CBI group than in the HFI group except for differences in the proportions of adults and secundigravidae who received third dose (Table 6.2.).

Table 6.2. Access and compliance with IPTp

Variable	HFI N = 230	CBI N = 221	p-value
Access to IPTp			
Proportion of women who received the first dose	51.2	48.8	-
Mean gestational age at recruitment in weeks	20.5 (±3.3)	19.4 (±3.9)	0.002
Mean gestational age at first dose in weeks	20.7 (±3.0)	19.9 (±3.3)	0.01
Proportion of women recruited in first trimester	2.4	7.6	0.03
Proportion of women who accessed SP1 in second trimester	97.1	98.6	NS
Proportion accessing the SP1 in third trimester	2.9	1.4	NS
Compliance			
Proportion of women who received SP2	67.5	89.1	0.001
Proportion of women who received SP3	44.2	69.1	0.001
Proportion of adolescents who received SP3	46.8	68.2	0.016
Proportion of adults who received SP3	42.8	9.5	0.001
Proportion of primigravidae who received SP3	40.4	70.5	0.001
Proportion of secundigravidae who received SP3	51.2	66.2	0.08

NS: not significant

Parasitaemia at recruitment

Blood samples were taken from 388 (87.2%) women at recruitment before the first dose of SP was administered. A total of 99 (25.5%) of those whose samples were examined were parasitaemic. Infections were due largely to *P. falciparium*, with three women having mixed infections of *P. falciparum* and *P. malariae*, whilst one had infection of *P. malariae* only. The prevalence of parasitaemia in the two groups is as shown in Table 6.3. Differences in parasitaemia prevalence among primigravidae did not differ at recruitment, after one dose of SP or after two doses of SP between HFI and CBI (Table 6.3). Similarly, differences in prevalence of parasitaemia among adolescents did not differ at recruitment, after one dose of SP or after two doses of SP between HFI and CBI. Parasitaemia prevalence was significantly ($p<0.0001$) higher in adolescents (39.7%) than in adults (19.1%). Differences in prevalence of parasitaemia between primigravidae (28.3%) and secundigravidae (20%) was not significant ($p=0.08$).

The geometric mean parasite density (GMPD/µl) for all infected women at recruitment was 719 parasites/µl (Table 6.3). Difference in GMPD between primigravidae (916 parasites/µl) and secundigravidae (363 parasites/µl) was significant ($p=0.02$). However, GMPD did not differ ($p=0.3$) between the adolescents and adults.

Effect of intervention on parasitaemia

The prevalence of parasitaemia reduced with increasing number of SP doses, with no significant difference between the HFI and CBI groups (Table 6.3). There was a highly significant ($p<0.001$) reduction of prevalence of parasitaemia from 25.5% at recruitment to 10.2% after the second dose of SP. However, prevalence of parasitaemia did not differ significantly ($p>0.05$) between the first and second SP doses. Prevalence among all primigravidae reduced significantly ($p<0.001$) between recruitment and after the second

SP dose. There was however no significant (p=0.2) reduction in parasitaemia prevalence among all secundigravidae between recruitment and after the second SP dose. Significant reductions in prevalence of parasitaemia was observed between recruitment and after second dose of SP for adolescents (p=0.02) and adults (p<0.006).

The GMPD/µl for the positive slides after first dose of SP was 493parasites/ µl and after second dose of SP was 4081 (Table 6.3). Significantly higher GMPD was observed for HFI compared with CBI after SP dose 1 (p=0.03) and after SP dose 2 (p<0.001). Within the HFI, significant (p=0.01) differences in GMPD was observed between the SP doses. In contrast, within the CBI, differences in GMPD between the SP doses were not significant (Table 6.3). GMPD increased after the second SP dose (Table 6.3). The high GMPD after the second dose was due to the very high parasite densities of 49,240 and 12,440 parasites/µl of blood for HFI and CBI respectively, recorded for one participant each from the two intervention groups. When these values were excluded from the calculation, there were still no significant differences in the GMPD for all the positive slides after SP dose 2 for HFI (p=0.4) and CBI (p=0.5). Differences in GMPD for parity (p=0.27) and age (p=0.2) were not significant. Eighty-two placenta samples were taken and parasitaemia was found in 2.4%. This was observed in two primigravidae with the woman from HFI taking only one dose of SP and the other woman from the CBI taking two doses of SP.

Table 6.3. Effect of IPTp on maternal peripheral parasitaemia

Variable	All women n = 388	HFI n =181	CBI n = 207	*p*-value
GMPD (parasites/μL)				
At recruitment	719	761	676	0.03
After SP dose1	493	535	473	0.05
After SP dose2	2016	4081	1308	<0.001
	p=0.01	*p*=0.01	*p*=0.25	
Prevalence of Parasitaemia				
At recruitment	99 (25.5)	51 (28.2)	48 (23.2)	0.26
After SP dose 1	36 (18.4)	12 (16.0)	24 (19.8)	0.5
After SP dose 2	13 (10.2)	5 (15.2)	8 (8.4)	0.27
	***p*< 0.001**	***p*<0.05**	***p*<0.009**	-
Gravida				
Primigravidae				
At recruitment	73 (28.3)	39 (31.2)	34 (25.6)	0.3
After SP dose 1	28 (20.6)	10 (18.5)	18 (22)	0.6
After SP dose 2	9 (10.3)	4 (17.4)	5 (7.8)	-
	***p*< 0.001**	***p*> 0.1**	***p*< 0.014**	-
Secundigravidae				
At recruitment	26 (20.0)	12 (21.4)	14 (18.9)	0.7
After SP dose 1	8 (13.3)	2 (9.5)	6 (15.4)	0.5
After SP dose 2	4 (9.8)	1 (10.0)	3 (9.7)	0.9
	p=0.2	*p*=0.4	*p*=0.5	
Age				
Adolescents (Below 20 years)				
At recruitment	48 (39.7)	28 (43.1)	20 (35.7)	0.4
After SP dose 1	14 (25)	3 (13.6)	11 (32.4)	-
After SP dose 2	9 (20.9)	4 (30.8)	5 (16.7)	-
	***p*=0.02**	***p*=0.04**	***p*=0.2**	-
Adults (20 years and above)				
At recruitment	51 (19.1)	23 (19.8)	28 (18.5)	0.8
After SP dose 1	22 (15.7)	9 (17.0)	13 (14.9)	0.8
After SP dose 2	4 (4.7)	1 (5.0)	3 (4.6)	0.9
	p=0.006	*p*=0.3	*p*= 0.03	

All, n at recruitment = 388, after SP 1 = 196, after SP 2 = 128
HFI, n at recruitment = 181, after SP 1 = 75, after SP 2 = 33
CBI, n at recruitment = 207, after SP 1 = 121, after SP 2 = 95

IPTp and Hb

The mean Hb of all the participants improved from 102.5g/l at recruitment to 110.0g/l at 36 weeks of gestation (Table 6.4). Mean haemoglobin of participants in the HFI was significantly ($p<0.0001$) higher than the mean Hb of participants in the CBI group at recruitment (Table 6.4). The participants recruited by the HFI group still had significantly (p<0.009) higher mean Hb than the participants recruited by the CBI group after SP dose 1 was taken. However, no significant differences were observed between the HFI and CBI groups thereafter. The prevalence of anaemia in the study population at recruitment was 67% but was significantly (p<0.001) reduced to 44.6% at 36 weeks of gestation (Table 6.4). There was significantly (p<0.0001) higher prevalence of anaemia among the CBI participants than the HFI group at recruitment. This difference persited between the intervention groups after SP dose 1 was taken. However, differences in anaemia prevalence between the intervention groups diminished after SP dose 2 was taken till 36 weeks of gestation. IPTp did not significantly (p = 0.16) reduce anaemia prevalence in the HFI group. In contrast, IPTp significantly (p<0.001) reduced anaemia prevalence among the CBI group. There was significantly (p = 0.004) higher anaemia prevalence among the CBI primigravidae compared with the HFI primigravidae at recruitment (Table 6.5). However, the difference between the groups did not persit after intervention. Prevalence of anaemia was significantly higher at recruitment and after SP dose 1 in secundigravidae who had CBI than HFI (Table 6.5). This difference disappeared between the intervention groups after SP dose 2. However, at 36 weeks of gestation, prevalence of anaemia was significantly (p = 0.03) lower among the secundigravidae in the CBI group than HFI group. At recruitment, adolescents (<20 years) in the CBI group had significantly higher prevalence of anaemia compared to the HFI group. Prevalence of anaemia in the adolescents showed no difference between the intervention groups after SP doses were taken.

At 36 weeks of gestation, significant differences were observed in both mean Hb (p<0.001) and prevalence of anaemia (p<0.001) when compared with prevalence at recruitment. No significant difference was observed between the parities ($p>0.9$) and between the age groups ($p>0.5$). Among the secundigravidae, prevalence of anaemia was significantly ($p=0.03$) lower for CBI compared with HFI at 36 weeks of gestation (Table 6.5).

Table 6.4. Effect of IPTp on Hb levels and anaemia prevalence

Variable	[a]All	[b]HFI	[c]CBI	*p*-value
Mean Hb (gm/l)				
At recruitment	102.5	105.9	99.3	0.0001
After SP dose 1	103.5	106.4	101.6	0.009
After SP dose 2	101.9	104.9	101.0	0.16
At 36 weeks	110.0	108.3	112.1	0.07
Anaemia (Hb<110gm/l)				
At recruitment	246 (67.0)	100 (56.5)	146 (76.8)	0.0001
After SP dose 1	121 (67.2)	41 (57.7)	80 (73.4)	0.03
After SP dose 2	74 (69.8)	15 (57.7)	59 (73.8)	0.1
At 36 weeks	62 (44.6)	39 (51.3)	23 (36.5)	0.08
	$p<0.001$	**$p=0.16$**	**$p<0.001$**	

[a]N at baseline = 367, SP 1 = 180, SP 2 = 106, at 36 weeks = 139
[b]N at baseline =177, SP 1 = 71, SP 2 = 26, at 36 weeks = 76
[c]N at baseline =190, SP 1 = 109, SP 2 = 80, at 36 weeks = 63
Figures in parentheses are anaemia prevalence (%)

Table 6.5. Anaemia prevalence by parity and age at recruitment and after IPTp

Variable	[a]All N (%)	[b]HFI N (%)	[c]CBI N (%)	*p*-value
Parity & anaemia				
Primigravidae				
At recruitment	169(69.3)	74 (60.7)	95 (77.9)	0.004
After SP dose 1	89 (71.8)	35 (68.6)	54 (74.0)	0.5
After SP dose 2	49 (70)	12 (63.2)	37 (72.5)	0.4
At 36 weeks	41(44.1)	24 (47.1)	17 (40.5)	0.5
Secundigravidae				
At recruitment	77 (62.6)	26 (47.3)	51 (75)	0.002
After SP dose 1	32 (57.1)	6 (30.0)	26 (72.2)	0.002
After SP dose 2	25 (69.4)	3 (42.9)	22 (75.9)	0.09
At 36 weeks	21(45.7)	15 (60.0)	6 (28.6)	0.03
Age & anaemia				
<20 years				
At recruitment	80 (69.0)	38 (60.3)	42 (79.2)	0.03
After SP dose 1	34 (70.8)	14 (73.7)	20 (69.0)	0.73
After SP dose 2	25 (73.5)	8 (80.0)	17 (70.8)	0.60
At 36 weeks	20(48.8)	13(59.1)	7(36.8)	0.16
≥20 years				
At recruitment	166(66.1)	62 (54.4)	104 (75.9)	0.001
After SP dose 1	87 (65.9)	27 (31.0)	60 (75.0)	0.006
After SP dose 2	49 (68.1)	7 (43.8)	42 (75.0)	0.02
At 36 weeks	42(42.9)	26(48.1)	16(36.4)	0.2

[a]N at baseline = 367, SP 1 = 180, SP 2 = 106, at 36 weeks = 139
[b]N at baseline =177, SP 1 = 71, SP 2 = 26, at 36 weeks = 76
[c]N at baseline =190, SP 1 = 109, SP 2 = 80, at 36 weeks = 63

IPTp and birthweight

Out of the total deliveries conducted, 83.8% were conducted at health facilities by midwives and doctors and 12.7% by trained TBAs and 3.5% by untrained TBAs and/or relatives at home.

Birthweights were recorded from 361 (80.1%) babies. Out of these, four were twin deliveries and seven were preterm babies. Three stillbirths and two neonatal deaths were recorded and these were excluded from further analysis. Analysis was focused on the 353 singleton births at term, excluding the twin deliveries. Proportion of male infants was 50.6% and that of female infants was 49.4%.

The mean birthweight for all study participants was 3066g (±431g) (Table 6.6). Mean birthweight of the infants delivered by the CBI group was significantly (p=0.04) higher than the mean birthweight for the HFI group. However, birthweights did not differ between the intervention groups for the SP doses. No significant difference was observed in effect of number of doses on mean birthweight (p=0.22). Within HFI, there was no significant (p = 0.52) difference between the SP doses for birthweight. Similarly, within CBI, no significant (p = 0.65) difference was observed between the SP doses. Differences in mean birthweight between HFI (2.983 kg; N=122) and CBI (3.064 kg; N=104) was not significant (p=0.16) for primigravidae. Similarly, differences in mean birthweight between HFI (3.095 kg; N = 59) and CBI (3.205 kg; N=61) was not significant (p = 0.16) for secundigravidae. Within HFI, differences in mean birthweight between primigravidae (2.983 kg; N=122) and secundigravidae (3.095 kg; N=59) was significant (p = 0.03). In contrast, within CBI, differences in mean birthweight between primigravidae (3.064 kg; N = 104) and secundigravidae (3.205 kg; N=61) was not significant (p=0.09). Differences in mean birthweight between HFI and CBI for adolescents (p=0.27) and adults (p=0.79) were also not significant. The overall LBW prevalence for the study population was 4.9% (Table 6.6). Prevalence of LBW was significantly (p=0.05) higher among the CBI group compared to the HFI group. However, differences were not observed in LBW prevalence between CBI and HFI for the individual SP doses (dose 1, 2 and 3) (Table 6.6). Differences in the proportion of LBW in primigravidae and secundigravidae was not significant (p = 0.1). The proportions of LBW in those who took one, two and three doses of SP were 7.5%, 4.9%

and 4.0% respectively (Table 6.6). There was a significant difference (p=0.03) in the proportion of LBW between the adults in the two intervention groups with a higher proportion from the CBI group.

Table 6.6 Effect of IPTp on birthweight

Variable	All women n = 346	HFI n = 181	CBI n = 165	*p*-value
Mean birthweight (g)				
Overall (mean ±SD)	3066 (431)	3020 (326)	3116 (519)	0.04
After 1 SP dose	2990	2976	3031	0.6
After 2 SP doses	3111	3050	3165	0.3
After 3 SP doses	3072	3030	3111	0.2
	p=0.22	p=0.52	p=0.65	
LBW prevalence (%)				
Overall	17 (4.9)	5 (2.8)	12 (7.3)	0.05
After 1 SP dose	5 (7.5)	2 (4.1)	3 (16.7)	0.08
After 2 SP doses	4 (4.9)	2 (5.3)	2 (4.7)	0.9
After 3 SP doses	8 (4.0)	1 (1.1)	7 (6.7)	

LBW = low birthweight

Reported adverse events related to SP

During each follow-up, the study participants were interviewed on any illnesses they had experienced since they took the previous treatment of SP. They were also advised to report immediately to a health facility when they felt unwell. Generally, the drug was well tolerated and few women reported severe adverse events after taking the drug. Vomiting within 30 minutes to two hours of taking the drug was reported by nine women, weakness by 14, dizziness by 4, headache by 5, abdominal discomfort by 5 and one reported nausea. These effects were mainly experienced after the first dose of SP which stopped after a short while without any intervention.

Discussion

The CBI providers recruited pregnant women with a relatively earlier mean gestational age compared with women attending regular ANC services. Compliance with IPTp was also higher in the CBI group than the HFI group. The higher compliance with the CBI might be due to easy access to the IPTp provider and follow-up home visits by the providers. Agyepong *et al.* (2002) reported from their study in Ghana that clients appreciate and interpret home visits as an indication that health care providers have interest in their health. The higher compliance by the CBI might also be explained by the methods of sensitization and mobilization used by the CBI team coupled with community support. The CBI team used approaches such as community meetings, engaged the services of the town crier, and personal contacts with the pregnant women and family, and individual health education that addressed local beliefs of malaria in pregnancy. Acknowledging local beliefs about the symptoms of malaria and incorporating them into the health education message improved compliance with malaria chemoprophylaxis for pregnant women (Helitzer-Allen *et al.*, 1993). Pregnant women's trust in the efficacy of the drug and the respect of community members for community health agents might also account for the higher compliance in the CBI group. Community health agents are highly respected in their communities because of the training they have received from the formal health system. This reinforces the importance of developing strong links between the formal health facilities and the community health agents to facilitate access to and increase compliance with IPTp. A healthy relationship between the two groups also has the potential of increasing compliance to interventions that might be provided solely by the health professional. The relatively lower compliance at the HFI could be explained by irregular ANC visits.

Similar observations were made in Malawi and Kenya (Launiala and Honkasala, 2007; van Eijk *et al.,* 2004). Lack of home visits and unreliable house numbers would make attempts at home visits by health professionals who are not members of a particular community difficult and less effective.

The parasitaemia prevalence in primigravidae and secundigravidae was 28.3% and 20.0% respectively at recruitment, which is comparable with the results of an earlier baseline survey which found a 30.4% and 20.8% prevalence in primigravidae and secundigravidae respectively (see Chapter 5). Similarly, parasitaemia prevalence in adolescents at recruitment (39.7%) was comparable to the district baseline survey findings of 33.9%. The prevalence in the adolescents also reduced from 39.7% to 20.9% supporting previous findings that IPTp with SP is effective in reducing maternal parasitaemia (Rogerson *et al.,* 2000; Tope *et al.,* 2007; Falade *et al.,* 2007; Mbonye *et al.,* 2008). Some of the reduction in the parasitaemia prevalence is as expected since prasitaemia peaks in the second trimester and fall towards delivery as immunity is regained (Brabin and Rogerson, 2001). Though pregnancy-associated malaria tends to be commoner in primigravidae, this study found no difference in prevalence and intensity of infection between primigravidae and secundigravidae. Rogerson *et al.* (2000) made similar observations in Malawi when they evaluated the effectiveness of IPTp-SP on mobidity in pregnancy. The study aimed at exploring the potential of community health agents in implementing IPTp for malaria control. Sixty-four percent (64%) and 46% reductions in prevalence of parasitaemia between recruitment and after SP dose 2 were obtained for CBI and HFI respectively. The higher reduction in parasitaemia prevalence in CBI compared with HFI may be due to differences in compliance between the CBI and the HFI and the relatively earlier period of recruitment for the CBI. Most women in the CBI group received their first SP dose early in the second trimester when parasiatemia is known to be at its peak (Brabin and Rogerson, 2001). This study however had a limitation of getting blood samples of some of the women after the third SP dose due to non-existing and unreliable house numbers hence the difference between the CBI and HFI should be interpreted with caution bearing this limitation in mind.

Prevalence of anaemia at recruitment was 69.3% and 62.6% in primigravidae and secundigravidae respectively, comparable to results of the baseline survey of 73.1% for primigravidae and 62.5% for secundigravidae. At recruitment, there was significant difference between the two intervention groups. Prevalence of anaemia was higher in the CBI groups than the HFI at recruitment and after the first and second SP doses but not thereafter. For all women, significant differences were not observed in the mean Hb and anaemia prevalence after the first and second SP doses but differences were observed at 36 weeks gestation. These changes may partly be attributed to haemodilution which occurs during mid-pregnancy which is the period when the first two SP doses were taken hence might have obscured the effect of the drug. The study did not find significant differences in anaemia prevalence by parity and age with repeated doses of SP though these are risk factors in stable malaria transmission areas (Verhoeff *et al.*, 1999, Achidi *et al.*, 2005). This observation is probably due to the multiple risk factors for anaemia and the interaction between factors including diet, helmintic infections, haemoglobinopathies, HIV/AIDS and socio-demographic factors (WHO, 1992; Kagu *et al.*, 2007).

IPTp led to an increase in birthweights and reduced prevalence of LBW. The overall mean birthweight was 3066 g (±431g) with overall LBW of 4.9%. Mean birthweight of 3116 g for CBI was significantly higher than mean birthweight of 3020 g for HFI. These figures are improvement over the baseline study result of the district's mean birthweight (2949g ± 486g) and prevalence of LBW (11.7%). The significantly higher mean birthweight in CBI compared with HFI may also be due to differences in compliance between the CBI and the HFI and the relatively earlier period of recruitment for the CBI. Several studies in other parts of Africa also observed beneficial effects of IPTp with SP on birthweights (Rogerson *et al.*, 2000; Njagi, 2002; Mbaye *et al.*, 2006; Mbonye *et al.*, 2008). The 4.9% LBW reported in this study is comparable to the LBW of 6.3% reported by Mbonye *et al.* (2008) in Uganda but lower than the 13.3% reported from Kenya by Njagi (2002). The differences in LBW could be due to differences in malaria transmission intensity and resistance to SP in those areas since SP has been used for IPTp in these countries for some years prior to the studies and probably its efficacy had reduced. For the present study area, this is the first time SP is being used for IPTp. Greenwood *et al.* (1989) and Mbonye *et al.* (2008) found community health agents such as TBAs, drug shop vendors and community reproductive health workers capable of implementing malaria interventions in pregnancy. Similar observations were made in the current study where TBAs and CBSVs have successfully implemented IPTp. This study therefore shows that IPTp can be successfully integrated into existing and informal healthcare systems already in place locally. The process in this study was facilitated through appropriate training, supervision and monitoring and we recommend its use in communities with less accessibility to the formal health system.

In Ghana, home-based care of malaria in children has been successfully implemented using chloroquine and artesunate-amodiaquine (Gyapong and Garshong, 2007; Ajayi *et al.*, 2008). Currently, home based care of malaria in children is being implemented in 16 districts of Ghana using artemisinin based combination therapy (ACTs) and this is expected to be scaled up to all rural communities in 123 districts throughout the country (MOH/GHS, 2008). In Ghana, 9% of maternal related mortality is due to malaria in pregnancy (MOH/GHS, 2008). To reduce the burden of pregnancy associated malaria, a complementary programme to the health facility IPTp would be to integrate IPTp into the home-based management of malaria. Community medicine distributors implementing the HBMM could be given additional training and support in administering IPTp in order to increase access to IPTp in deprived rural areas.

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Chapter 7

Improving coverage of and compliance with interventions for pregnancy-associated malaria: the health care providers' and community-based health agents' perceptions of IPTp implementation in Afigya Sekyere district

Chapter 7: Improving coverage of and compliance with interventions for pregnancy-associated malaria: the health care providers' and community-based health agents' perceptions of IPTp implementation in Afigya Sekyere district

Abstract

Though intermittent preventive treatment in pregnancy (IPTp) with sulphadoxine-pyrimethamine (SP) is effective against the adverse consequences of malaria, access and compliance with the intervention has been poor in many areas. Consumers and health care providers' perceptions influence the success and implementation of health interventions. A study was carried out to assess the uptake of IPTp in the Afigya Sekyere district and explore the providers' perception on access and compliance with the intervention. Access to IPTp-SP was 44.8% and less than 50% of the women who accessed the first dose complied with the recommended three doses. Primigravidae accessed IPTp-SP earlier than women of higher parities. Factors identified to influence access and compliance were non antenatal clinic (ANC) attendance, late first ANC visit and irregular ANC visits. Strategies to improve coverage and uptake of the intervention include intensifying health education on ANC attendance and IPTp-SP, involvement of community health nurses in implementation of IPTp at outreach clinics and improving home visits. Trained community health agents can complement the efforts of the professional health workers by disseminating information on IPTp-SP and malaria interventions in general, undertake home visits, trace defaulters and also provided IPTp with regular supervision from the health staff. To improve access to IPTp-SP and compliance in less accessible areas, closer link between health staff and trained community health agents is recommended. Since primigravidae experience severe consequences of anaemia and higher prevalence of LBW but are more likely to have an

early first ANC visit, they should be targeted for intensified individual health education to make them well informed to practice malaria preventive measures during pregnancy.

Introduction

Similar to other malaria-endemic countries, malaria is a priority health problem in Ghana. It accounts for 44.1% of outpatient cases and 13.4% of all deaths reported from health institutions (GHS, 2007). Malaria accounts for 13.1% of all disease events reported by pregnant women at health institutions and is also responsible for 90% of deaths among the pregnant population (MOH/GHS, 2008). The Ghana National Malaria Control Programme (NMCP) adopted the World Health Organization's (WHO) recommendation of using sulphadoxine-pyrimethamine (SP) for IPTp and this service is delivered at health facilities only (GHS, 2004; GHS/NMCP, 2005). To facilitate the delivery of the service as a component of a comprehensive antenatal care (ANC) package and monitor uptake, the Ghana Health Service (GHS) redesigned the antenatal record book and registers to reflect administration of IPTp with SP. Though there is a high ANC coverage (88.1%), reports indicate that the proportion of pregnant women who accessed one dose of IPTp with SP was 64.3% and the proportion that received all three doses was 31.4% in 2007 (NMCP, GHS Review 2008). SP used for IPTp has been reported to be effective against adverse consequences of pregnancy-associated malaria (Shulman *et al.*, 1999; Rogerson *et al.*, 2000; Njagi, 2002; Falade *et al.*, 2007; Tope *et al.*, 2007; Mbonye *et al.*, 2008). However, challenges with access and compliance with the full course have been reported (van Eijk *et al.*, 2004; Mbonye *et al.*, 2007; Gikandi *et al.*, 2008) necessitating the need for identification of strategies to address these challenges. Various reasons have been assigned for the low coverage and compliance, which include late start of ANC visit, lack of women's knowledge of IPTp-SP, unclear health education messages and omission of instructions from health providers during SP administration (Launiala & Honkasalo, 2007). Even in cases where health services are free, people have still not accessed services due to factors like transport cost and long waiting hours. The WHO expert committee on IPTp recommended the need for studies that will optimize the uptake of IPTp (WHO, 2007). The perceptions of providers and consumers of the value of an intervention have been observed to influence its acceptability (Robb, 1999) and hence uptake. Some studies have elicited the consumers' views on ANC and IPTp- SP (van Eijk *et al.*, 2004; Mbonye *et al.*, 2007; Launiala & Honkasalo, 2007; Gikandi *et al.*, 2008). A study was therefore designed to assess coverage and providers' perceptions of access and compliance with IPTp in the Afigya Sekyere district after two years of implementation. The objectives were to identify factors influencing coverage and compliance with the recommended doses and to identify strategies to improve these parameters. The Afigya Sekyere District Health Management Team (DHMT) has the objectives of improving the health status of the people in the district through the provision of high quality and efficient health services that are accessible with the involvement of all stakeholders and intends increasing geographical access to health services (DHA, 2007). This study also seeks to identify ways by which this can be achieved for the control of malaria in pregnancy.

Materials and methods

Study area and population

The population of the district has been described elsewhere (see Chapter 2). The district covers an area of 780 square kilometers and about 90% of the roads are feeder roads and accessibility to the hinterland becomes difficult during the rainy season (DPU, 2005;

DHA, 2005). The district health service is understaffed. However, the district has a large number of community health agents which have been identified and trained by the DHMT on relevant health issues and procedures. These personnel include 132 community-based surveillance volunteers (CBSVs), 52 traditional birth attendants (TBAs), and 41 chemical sellers (DHA, 2007). Malaria transmission is perennial and intense, and malaria accounts for about 67.5% of outpatient cases and more than 60% of hospital admissions annually in the district. Women in the reproductive age group form about 22.5% of the population and the expected pregnancy rate is 4% (DHA, 2004; 2005; 2007). Uptake of ANC services is averagely about 69.6% and only 59.5% of deliveries are supervised indicating that a substantial number of pregnant women are not accessing reproductive health services from the formal health facilities. The proportion of women in the study district who made four or more ANC visits was only 22% (DHA, 2007).

The study population was midwives, CBI implementers, pregnant women of all parities who accessed IPTp in the year 2006 and 2007.

Study design

Exploratory and descriptive designs were use in this sub study to assess the implementation of IPTp.

Training, drug administration and laboratory procedures

Data was collected from all the health facilities and community health agents in the district, using both quantitative and qualitative methods. Implementation of IPTp-SP was started in the district from the middle of 2005. All midwives received training in focused ANC to provide a comprehensive antenatal package which includes IPTp-SP, iron and folate supplementation and insecticide treated nets (ITNs) to pregnant women. The training focused on: malaria in pregnancy and its adverse effects, malaria prevention strategies, use of SP for IPTp, record-keeping and taking peripheral and placental blood samples for parasitological examinations. The District Health Management Team (DTHM) organized community durbars to discuss the new antimalaria policy, malaria in pregnancy and preventive measures including IPTp with SP and use of ITNs, and the importance of early ANC attendance.

The midwives administered a single-dose of SP (1500/75mg) to pregnant women of all parities with daily iron and folate supplementation. The first dose was given from 16 weeks gestation or after quickening and the subsequent doses were given at intervals of at least one month. The women were supposed to receive a complete course of three doses before 36 weeks of gestation. At the first ANC visit and at 36 weeks maternal haemoglobin (Hb) levels were measured. The laboratory results were entered in the ANC register.

Data collection

Data was collected from all health facilities in the district for the period of 2005 – 2007. This included data on the routine administration of IPTp with SP at health facilities, antenatal and delivery records. Data was collected by four research assistants, supported by the midwives from the ANC registers and IPTp administration notebooks. The data focused on ANC attendance, gestational age at registration, maternal age, parity and number of IPT doses received. Data was collected on the total number of SP tablets received per year per health facility and the number of women who accessed IPT dose 1, 2 and 3 for each year. Data was also collected from the District Health Administration on the SP supply to the health facilities.

In a qualitative survey, key informant interviews (KII) were held with midwives and community health agents (TBAs and CBSVs) who administered IPT (see Chapter 6). Midwives were interviewed regarding their perceptions on the implementation process, access and compliance by pregnant women. The community health agents (TBAs and CBSVs) were also interviewed on their experiences with the process. The interviews explored the different ways used in recruiting women and perceptions on strengths and weaknesses of implementing IPTp, challenges of access and compliance and how to improve on them.

Data processing and analysis

Quantitative data was entered into Microsoft Access (Microsoft, USA) and analysis done using SPSS® for Windows® version 16.0. (SPSS Inc. 2007, USA). Proportions were computed and compared using Chi-square test. A probability of $p<0.05$ was considered significant for all tests. Access was defined as being able to receive a first dose of SP and the access rate as the proportion of expected pregnancies for each year who received the first SP dose. Compliance was calculated as the proportion of women who took the maximum three doses of SP before delivery. Qualitative data from the key informant interviews were entered in Microsoft word and analyzed manually.

Ethical considerations

Ethical approval for the study was obtained from the Committee on Human Research Publications and Ethics of the School of Medical Sciences, KNUST, Ghana and the

Danish National Committee for Biomedical Research Ethics. Administrative approval was obtained from the Afigya Sekyere District Health Management Team (DHMT), Ghana Health Service, Agona. All heads of health institutions in the district were formally informed by the District Director of Health Services. Sensitization meetings were held with midwives and recognized community health agents and they gave verbal consent for participation.

Results

Background characteristics of pregnant women

Data was collected on 3067 women from ANC and IPTp drug administration books for the period June 2005 to December 2007. Data was also collected on the total number of IPTp administered from the midwives' IPTp summary books. Of the 3067 women, 15.1% were primigravidae, 23.1% were secundigravidae and 61.8% were multigravidae. There were 369 (12.6%) adolescents between 13 and 19 years of age, 2136 (73.1%) were adults between 20 and 34 years and 417 (14.3%) were between 34 and 45 years. The mean age was 26.5 (SD=±6.3) years.

The mean gestational age at first ANC visit was 21.9 (±5.9) weeks. Significant ($p<0.001$) differences in mean gestational age at first ANC visit was observed between the parities. The gestational age at which primigravidae reported at the first ANC was earlier (19.9 ± 5.0 weeks) than secundigravidae and multigravidae (Table 7.1). There was a significant ($p<0.005$) difference in mean gestational age at first ANC visit between primigravidae and secundigravidae. However, the difference between secundigravidae and multigravidae was not significant ($p>0.05$). The proportions of the women who had their first ANC visit during the first, second and third trimesters were 12.9%, 67% and 20.1% respectively.

Access and compliance to IPTp

The district received the first consignment of SP for IPTp in June 2005 and started implementation in only two out of the 13 health facilities that year. In 2006, eleven health facilities implemented the programme and in 2007 all 13 health facilities in the district implemented it. Analysis for access and compliance is focused on implementation in 2006 and 2007 since only two facilities implemented IPTp in 2005.

The expected pregnancies for 2006 and 2007 were 5822 and 6020 respectively. The district's records indicate that enough SP doses had been acquired for the expected number of pregnancies for each year. Three hundred and forty women whose first ANC visit was after the first trimester did not receive SP at the first visit. The rate at which women accessed IPTp-SP for the two years was 44.8% (5306/11842). Access rate for 2006 and 2007 were 42.2% (2457/5822) and 47.3% (2849/6020), respectively. The proportion of women who accessed the intervention and complied with the three doses was 49.8% for both years. The proportions of the total expected pregnancies that complied with three doses were 22.3% (both years), 23.8% in 2006 and 20.9% in 2007. There was no difference in compliance between the parity groups ($p>0.05$) and the age groups ($p>0.05$). Majority of the women (71.6%) accessed the first dose of SP in the second trimester. The mean gestational age at which women accessed the first SP in the second and third trimesters are 20.3 weeks and 30.5 weeks respectively. Table 7.1 shows how the three parity groups and age groups accessed IPTp.

Table 7.1. Access and compliance to IPTp with SP in relation to parity and age

Variable	Parity			*P*-value
	PG	SG	MG ≥3	
Mean gestational age at 1st SP dose (weeks)	19.9 (5.0)	21.5 (6.1)	22.0 (6.1)	0.001
Proportion that accessed SP 1(%)	81.0	91.5	85.6	0.001
Proportion that accessed SP1 in second trimester (%)	78.3	70.1	70.1	0.002
Variable	**Age groups (years)**			*P*-value
	13 – 19	20 – 34	≥ 35	
Mean gestational age at 1st SP dose (SD) (weeks)	21.6 (5.4)	21.8 (6.0)	22.2 (5.8)	0.50
Proportion that accessed SP1 (%)	90.1	87.6	88.3	0.40
Proportion that accessed SP1 in second trimester (%)	77.1	70.9	70.6	0.12

PG – primigravidae, SG – secundigravidae, MG – multigravidae (≥3)
Figures in parentheses are standard deviations

Health providers' perceptions on access and compliance

During the key informant interviews the midwives indicated two major challenges related to the implementation of the IPTp programme. The main challenge was irregular ANC visits by the pregnant women and this was reported by 11 out of the 13 health facilities. The other major challenge was irregular drug supply which led to non-availability of SP at health facilities at the time that some women visited the clinic. This latter reason was however peculiar with the Mission health facilities. Their perceptions on why the pregnant women did not receive the three doses included; irregular ANC visits, no follow-up ANC visits, late first ANC visits in the second trimester (all facilities), and first ANC visit in the third trimester. The providers' suggestions for increasing access and improving compliance covered five major areas. These were; intensifying health education, improving ANC coverage, early reporting at ANC, home visits and involvement of community health nurses in the administration of IPTp. They suggested that health education should emphasize the need to attend ANC regularly and to start in the first trimester. They also suggested that staff should intensify home visits and community health nurses should be made to implement IPTp at the outreach clinics (Maternal and Child Health Clinics). The mode of recruitment and sensitization used by TBAs and CBSVs for primigravidae and secundigravidae in the community implementation of IPTp was explored. Multiple approaches were adopted in recruiting women. These included identification of pregnant women by the TBA or CBSV themselves, information from other community members on pregnant women, by announcing the programme through the town-crier, and through community meetings. Some women also approached the TBAs and CBSVs by themselves for recruitment into the IPTp programme. They suggested the need for increased community sensitization, extension of IPTp to cover all pregnant women, home visits, cordial relationship between midwives and the community health agents to facilitate information flow as ways by which access and compliance could be improved.

Discussions

The results have shown that primigravidae accessed the first dose of SP earlier in the second trimester than women of higher parities. This observation may be explained by the fact that primigravidae are inexperienced with pregnancy and might want to know the status of their foetus and also seek care early in the pregnancy in order to acquire the necessary knowledge to take care of the pregnancy. This finding provides a window of opportunity for health promotion and education on malaria in pregnancy and its interventions. Although 71% of the women accessed the first SP dose in the second trimester, less than 50% of these complied with the three doses. Irregular ANC attendance was responsible for the high non-compliance. More than 20% of the women accessed the first dose in the third trimester after 30 weeks of gestation. In adhering to the malaria policy guidelines, this category of women will not be able to receive 3 doses since their pregnancy will be more than 36 weeks when they are due for the third dose. The observation that irregular and late first ANC visits are the main factors responsible for poor compliance with IPTp-SP is not peculiar to the Afigya Sekyere district. Other studies on implementation of IPTp with SP have made similar observations (Guyatt *et al.*, 2004; van Eijk *et al.*, 2004; Mbonye *et al.*, 2007; Launiala and Honkasala, 2007). van Eijk *et al.* (2004) in assessing the implementation of IPTp in Kenya observed that 45% of their study women started attending ANC in the third trimester and therefore could not access the required doses.

In the exploratory study of pregnant women's perception on malaria, some of the reasons the women gave for patronizing ANC services were; to know the condition of the baby, availability of drugs and ill-health. The finding that pregnant women are motivated to visit ANC because they would like to know the condition of their babies has also been reported by Launiala and Honkasalo (2007) in Malawi. Medical examinations are valued and enhance confidence and hope for a good pregnancy outcome (Whyte, 2005; Launiala and Honkasalo, 2007) because it provides knowledge that the baby is growing well. It has also been observed that some women only visited the ANC to get the ANC card to be sure of the midwife's attention in the event of complication during delivery. Launiala and Honkasala (2007) also elicited the factors influencing timing of first ANC visit in Malawi. Their findings included the woman's desire to confirm pregnancy, beliefs in witchcraft that discourage early disclosure of pregnancy, and distance from health facility. As expected, the midwives in the present study observed that regular and early ANC attendance is the key to compliance. A woman would need a minimum of three ANC visits between the second and early third trimester to be able to receive the maximum three doses of SP. In the Afigya Sekyere district, the average ANC visit per client is four with 22% of the clients having four or more visits (DHA, 2007) but only a low proportion of women were able to access the three SP doses.

The inability of about 50.2% of the pregnant women to access three doses of SP might be due to the fact that 20.1% of the pregnant women had the first ANC visit in the third trimester. There is a high probability that they will not be able to access the three doses since SP will not be administered after 36 weeks of gestation. The pregnant women could not access the three doses also because of irregular ANC visits by 87.1% of the pregnant women who had their first ANC visits in the first and second trimesters. Also, in a few of the health facilities, irregular supply of drugs accounted for the women not getting the three doses though they visited the ANC. One of the reasons for which pregnant women attend ANC is to receive drugs. If this expectation is not met and the reasons for not providing drugs are not communicated to them, there is the likelihood that it will undermine their confidence in the health system and they may not return for follow-up visits. This challenge can be addressed by ensuring regular supply of drugs at all facilities and regular flow of information between the facilities and the District Health Administration on stock at the various levels and replenishing stock as early as necessary. In addition, pregnant women should be informed of what services they may not get at each visit and given the assurance of it being provided when resources permit.

The midwives and community health agents indicated the need to intensify health education on IPTp in the community targeted at the entire population. At present education on IPTp is mostly done at health facilities and outreach clinics and only to pregnant women. Occasionally, community education programmes are organized but these are inadequate to have a sustained impact on behaviour change of all women in the reproductive age hence there is the need to intensify it. Intensifying the education alone may not be enough to increase access and improve compliance if this education does not take into consideration local perceptions about illnesses and pregnancy. Helitzer-Allen *et al.* (1993) found that in Malawi, acknowledging local beliefs about the symptoms of malaria and incorporating these into the health education message improved compliance with malaria chemoprophylaxis for pregnant women. In the exploratory study on the community's perceptions and practices on malaria in pregnancy, respondents (pregnant women, community health agents, and opinion leaders) held various views about the causes and risk factors for the disease and its consequences. Educational strategies and messages that seek to demystify issues of pregnancy and superstition, emphasize benefits of early ANC and explain the timing of IPT with SP would be useful. Community health educational programmes should incorporate aspects that permit individual members to correct misconceptions related to pregnancy. Pregnant women's limited knowledge on IPT with SP has been partly attributed to unclear health education messages at ANC sessions and omission of instructions during the SP administration (Launiala and Honkasalo, 2007). It is important that instructions and education are repeated at each ANC visit and the women should be given the opportunity to clarify their perceptions on pregnancy and malaria interventions.

Community health workers have also been found to be suitable in increasing awareness to programmes and compliance to health interventions (WHO, 2003). Involving TBAs and CBSVs could be a complementary strategy in disseminating information on IPTp and other interventions for malaria in pregnancy as they live within the community, are respected and are conversant with the community members' perceptions on health issues. They will however need to be given training, accurate and specific messages to disseminate in their communities, targeting mainly the at-risk groups for impact.

One of the strategies needed to improve access and compliance as suggested by the midwives is to involve the community health nurses (CHN) in the implementation of IPTp-SP during their outreach programs. The idea of involving the CHNs is based on the premise that during outreach clinics, health service is brought closer to the community and thus reduces travel time and transport cost thus increasing access to the service. It is however true that in rural communities that depend mainly on farming for their livelihood some people will be working on the farm at the time when the outreach clinic is being organized. There is therefore the need to link up with recognized community agents to sensitize and mobilize the women to access the service. In the Afigya Sekyere district, these agents include the CBSVs and TBAs. There are CBSVs in every community and they already support the outreach health staff by organizing the venues for the clinics. Their ability to administer malaria chemoprophylaxis or IPTp has previously been tested and proven (Greenwood *et al.*, 1989; Mbonye *et al.*, 2007) and they could be empowered to do defaulter tracing and invite women to the ANC. Clients appreciate and interpret home visits as an indication that the health personnel have interest in their health (Agyepong *et al.*, 2002). Home visits have also been noted by the midwives, TBAs and CBSVs as a way of increasing access and compliance. However, due to the current acute inadequate number of professional staff, this option does not look feasible if it has to be performed by the midwives. Coupled with this is the problem of unavailable and unreliable house numbers provided by some women which makes it difficult for the midwives to trace them. The services of the community agents will be useful in this regard also. In some cases where the default period exceeds the maximum interval between SP doses, the drugs could be given to the community agents to administer to the woman at home and impress on her to visit ANC to access other services. Getting the community agents involved could improve information flow between the formal health service and the community and facilitate monitoring of IPTp implementation.

Limitations

Since part of the data in this study was secondary data from health facilities, records on demographic characteristics of the women was limited hence the influence of socio-demographic factors on compliance could not be assessed. Pregnant women were also not interviewed to elicit reasons for not accessing IPTp and non-compliance with the recommended three doses. Though studies in other malaria endemic areas have looked at this issue, it is possible there could be differences in local perceptions on IPTp. Further research is recommended on client perceptions of IPTp in the district.

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Chapter 8

General Discussions, Conclusions and Recommendations

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General discussion

Malaria in pregnancy poses a risk to the woman and the foetus. Though IPTp with SP is effective against adverse pregnancy outcomes due to malaria and the delivery strategy is simple, there are still problems with access and compliance. The present strategy of delivering IPTp only at antenatal clinics limits its access to many women in remote and inaccessible rural communities. This study was conceived out of the need to identify appropriate and feasible delivery strategies to provide IPTp to women in deprived communities in order to make a sustained impact on pregnancy-associated malaria. Community health agents are readily available in most rural communities in Africa. In Ghana, TBAs and CBSVs have received and continue to receive training from the formal health system to support implementation of health interventions in rural communities. This study was designed to explore their potential in delivering IPTp to pregnant women in deprived communities to improve access and compliance and assess its effect on parasitaemia, anaemia and birthweight. The study was conducted in three phases using both qualitative and quantitative methods.

Robb (1999) observed that successful implementation of health interventions is influenced by both provider and the consumers' acceptability of the intervention. Qualitative methods were used in exploring community perceptions on malaria in pregnancy and the health care providers' perceptions on access and compliance with IPTp. This was to provide information on local beliefs on malaria in pregnancy which should be considered in targeted health education messages by providers of IPTp. This is envisaged to facilitate uptake of the intervention as observed by Helitzer-Allen *et al.*, (1993). Health behaviour is determined by personal beliefs or perceptions about disease and strategies available to decrease its occurrence (Hochbaum, 1958). A study was therefore conducted among pregnant women, community health agents and opinion leaders to explore their perceptions on malaria and anaemia in pregnancy and the consequences of suffering any of these conditions. The study observed that the term 'malaria' was very familiar to the study participants, majority was aware of the causes of malaria. A few had misconceptions of the causes and perceived that the disease is due to long stay in the sun, eating oily and starchy foods, similar to what was found from studies in other parts of Ghana (Agyepong, 1992; Ahorlu *et al.*, 1997). They had fair knowledge of the major symptoms of malaria and anaemia, and their preventive measures. The findings have shown that perceptions on the consequences of malaria in pregnancy varied from serious illness to fatality for the woman and the foetus. These findings are similar to the findings of Launiala and Kulmala (2006). Majority of the pregnant women did not associate malaria with anaemia and rather perceived that anaemia is caused by poverty. However, malaria-related anaemia has been reported to contribute significantly to LBW which is a risk factor for perinatal mortality (Brabin and Piper, 1997). If pregnant women do not identify malaria as a major cause of anaemia, and anaemia as a major cause of LBW, then behavioural changes towards malaria prevention are likely not to be effected. Our respondents' attribution of malaria to long stay in the sun and their perception that anaemia is caused by poverty and strenuous work could be linked to their major occupations which are farming and trading which exposes them to the heat of the sun. Respondents in some earlier ethnographic studies in Ghana by Avotri and Waters (1999) and De la Cruz *et al.* (2006) also associated ill-health with hardwork and anaemia to poverty (Galloway *et al.*, 2002).

In order to adequately assess the impact of IPTp on parasitaemia, anaemia and birthweihgts, two baseline studies were conducted before the implementation of the IPTp study. One was aimed at describing the district's mean birthweight and prevalence of LBW and the second was to assess the prevalence of malaria and anaemia among pregnant women who had not used IPTp. Data was collected on birthweights from all health facilities in the district from 1999 to 2003. Parity and age were associated with mean birthweight and prevalence of LBW, and seasonal patterns were also observed in the distribution of birthweights. The mean birthweight was 2949g (±486) with an overall LBW prevalence of 11.7%. Infants delivered in the dry season were significantly heavier than infants delivered in the rainy season. The mean birthweight reported is similar to those reported from Tanzania, Zimbabwe and Burkina Faso (Banje, 1983, 1987; Dole *et al.,* 1990; Walraven *et al.,* 1997; Wendl-Richter, 1997), low when compared with findings from Southern Cameroon by Akum *et al.* (2005); but higher than the means reported from rural Zaire (Fallis and Hilditch, 1989). Some authors have reported a positive correlation between parity and birthweight (Eriksson *et al.* 1997; Feleke and Enquoselassie, 1999; Andersson *et al.*, 2000; Kulmana *et al.*, 2001). In this study, higher parity was associated with higher birthweight. Sheferaw (1990) also observed positive effect of parity on birthweight through parity 5 from a study in Ethiopia. In contrast, Dhall and Bagga (1995) reported in Northern India a significant effect of parity for only secundigravidae but none thereafter. This observation may be partly attributed to the susceptibility of primigravidae to severe malaria infection. In primigravidae, the placenta becomes heavily parasitized with *P. falciparum* due to the mediating factor of the CSA parasite binding which interferes with transplacental nutrition due to inflammatory changes in the intervillous space in relation to the cytotrophoblast thus contributing to LBW (Rogerson *et al*., 2007b; Guitard *et al*., 2008). The prevalence of 11.7% LBW is similar to the prevalence of 9.3% and 14.9% reported from neighboring Burkina Faso (Wendl-Richter, 1997; Blanc and Wardlaw, 2005) and 14.1% from Tanzania (Walraven *et al*., 1997). Malaria infection could contribute to high LBW (Shulman *et al*., 2001; Akum *et al*., 2005). The high prevalence of 37.5% LBW observed in adolescents (<20 years) who were mostly primiparae in this study is similar to the findings of Wort *et al*. (2006) who also reported high prevalence of LBW among adolescent women in Tanzania. Adolescent pregnancies are connected with low socio-economic status, which in turn diminishes the mother's ability to nourish the foetus (Phung *et al*., 2003; Keskinoglou *et al*., 2007). This high level of LBW in the adolescents may also be partly attributed to competition for nutrients between the foetus and the adolescents who are still in the growth stage and also due to poorer placental function which increases the risk of LBW (Olson, 1987; Scholl *et al*., 1990; Brabin and Brabin, 1992; Wort *et al*., 2006). The pattern of highest mean birthweight occurring during the dry season and lowest during the rainy season is consistent with the findings of Aitken (1990), Ceesay *et al*. (1997), and Wendl-Richter (1997). Rainy season has been associated with high incidence of malarial transmission (Aitken, 1990; Bantje, 1983; Ndyomugyenyi and Magnussen, 2001) and lower haemoglobin levels (Bouvier *et al*., 1997; Hinderaker *et al*., 2001) both of which contribute to LBW. Higher maternal labour output and lower food intake may also be responsible for the decline in birthweight during the rainy season. Seasonal variation in mean birthweight has been associated with countries whose economies are heavily dependent on local agriculture (Bantje, 1987; Fallis and Hilditch, 1989) as pertains in the Afigya Sekyere district.

The prevalence of malaria (19.2%) and anaemia (62.8%) in pregnancy at baseline were high in the district. Severe anaemia was found in 2.4% of the pregnant women. *P. falciparum* was the predominant species and parasite rates were high during the second trimester. The study identified age and parity as risk factors for malaria in pregnancy and also for intensity of infection in the district. It also identified age, parity, malaria and gestational age as risk factors for anaemia in pregnancy. Primigravidae and adolescents were at a higher risk of parasitaemia with higher infection intensity than multigravidae and adults. Risk factors previously identified for malaria in pregnancy include age and parity (Brabin 1983, WHO, 2000, Desai *et al.,* 2007). The parasitaemia prevalence of 19.2% is comparable to the prevalence from studies in other endemic areas with comparable levels of malaria transmission (Desai *et al.,* 2007; Coulibaly *et al.,* 2007). The observation that women of lower gravidity and adolescents were more susceptible to parasitaemia and infection intensity is attributed to the naivety of the primigravid placenta to the placenta-specific *P. falciparum*. The observed increased parasite rate in the second trimester is consistent with previous findings from endemic areas that parasitaemia prevalence peaks in mid-pregnancy (Brabin and Rogerson, 2001). This is attributed to a decrease in recovery rates during mid-pregnancy and a subsequent increase in the recovery rate from the infection. The study observed a pattern of variation in haemoglobin concentration by gestational age and Hb levels decreased during the second trimester and increased from the end of this semester through the third trimester. This is partly attributed to haemodilution which occurs during mid-pregnancy due to increased plasma volume (Verhoeff *et al.,* 1999). This may also be partly attributed to malaria. Parasitaemia rates from the study were significantly associated with prevalence of anaemia and more parasitaemic women were anaemic compared to the aparasitaemic women, suggesting malaria as an important cause of the anaemia. Parasitaemia peaks between 9 and 16 weeks of gestation (Brabin, 1983; WHO, 2000) and maternal anaemia has been observed to peak shortly after this period (Gilles *et al.*, 1969). It is also observed that in stable malaria transmission areas, there is early resolution of the frequent malaria attacks and most women are asymptomatic. Peripheral parasitaemia may be low or absent but placental parasitaemia may persist, causing anaemia (Rogerson *et al.*, 2007a). Considering the adverse effects of malaria on pregnancy outcomes, various preventive strategies are being implemented to mitigate this. These strategies include use of ITNs, chemoprophylaxis and IPTp. The adoption of IPTp with SP was based on the efficacy of SP, its good safety profile in pregnancy and the simple delivery strategy as directly observed therapy (DOT) to enhance compliance.

IPTp was provided by community health agents and by midwives at health facilities to primigravidae and secundigravidae. The CBI providers recruited pregnant women relatively earlier and recorded higher compliance with the IPTp than the HFI group. The parasitaemia and anaemia prevalence in this group at recruitment were similar to the district baseline. Parasitaemia of 25.5% at recruitment reduced to 10.2% after two doses of SP. Anaemia was also reduced from 67% at recruitment to 44.6% after IPTp. Mean birthweight after IPTp was 3066 (431) gm and LBW was 4.9%. These figures are improvements over the mean birthweight and LBW prevalence obtained in the baseline study. The reduction in the prevalence of parasitaemia, anaemia and LBW after IPTp supports earlier findings that IPTp with SP is effective against adverse pregnancy outcomes in malaria endemic areas (Rogerson *et al.*, 2000; Falade *et al.*, 2007; Tope *et al.*, 2007; Mbonye *et al.*, 2008). Prevalence of malaria significantly reduced with higher doses of IPTp. The study did not find differences in prevalence of malaria and infection intensity between primigravidae and secundigravidae. Rogerson *et al.* (2000) made similar observations in Malawi when they evaluated the effectiveness of IPT-SP on the morbidity of pregnant women. The absence of any difference in parasitaemia prevalence between primigravidae and secundigravidae suggests that they are both high risk groups contrary to earlier reports that malaria is solely a problem of primigravidae. The study aimed at exploring the potential of community health agents in implementing IPTp for malaria control based on the presumption that early identification of pregnant women for malaria preventive intervention is important for impact to be made. A reduction in parasitaemia from 23.2% at recruitment to 8.4% after SP dose 2 by CBI was lower than the reduction seen in HFI. This might be due to differences in compliance between the HFI and the CBI and the relatively earlier recruitment into the CBI. Most women in the CBI group received their first SP dose early in the second trimester when parasiatemia is known to be at its peak (Brabin and Rogerson, 2001). Significant differences were observed in mean Hb and anaemia prevalence at 36 weeks and not after the first and second SP doses. This observation could be partly attributed to haemodilution during mid-pregnancy which might have obscured the effect of the drug. IPTp increased birthweights and reduced prevalence of low birthweights. Several studies in other parts of Africa also observed beneficial effects of IPTp with SP on birthweights (Rogerson *et al.*, 2000; Njagi, 2002; Mbaye *et al.*, 2006; Mbonye *et al.*, 2008). Our observed 4.9% LBW is comparable to 6.3% observed in Uganda by Mbonye *et al.* (2008) but lower than 13.3% in Kenya (Njagi, 2002). The differences in the LBW prevalence might be due to differences in malaria transmission intensity and reported resistance to SP in these other areas where IPTp-SP has been used for some years. In contrast, this is the first time SP is being used for IPTp in Ghana.

The high compliance with the CBI could be due to several factors. One of these factors is the easy accessibility to the CBI provider and follow-up home visits by the providers. Agyepong *et al.* (2002) observed that clients interpret home visits as the health care provider's interest in their health. The other probable factor is the several methods of sensitization and mobilization used by the CBI team coupled with community support and health education that took into account community beliefs. Helitzer-Allen *et al.* (1993) observed from their study that acknowledging local beliefs about malaria symptoms and incorporating them into health education messages improved compliance with malaria chemoprophylaxis for pregnant women. Another factor that might have contributed to the high compliance is the pregnant women's trust in the efficacy of the drug because it was linked to the formal health system and the knowledge that community health agents had received training from the formal health system. Thus, the continual equipping of community health agents with appropriate health educational messages and interventions by formal health service staff will facilitate access to and increase compliance with IPTp.

Launiala and Honkasala (2007) elicited the consumers' views on factors influencing ANC attendance and compliance with IPTp. The low compliance of IPTp at health facilities necessitated the need to explore the health care provider's (HCP) perceptions on the poor access to and compliance with the routine IPTp being provided and to identify measures to mitigate this. The observations that only 44.8% of the expected pregnancies accessed SP and only 49.8% of those who accessed the first dose complied with the three recommended doses; more than 71% of the women who accessed IPTp accessed the first SP dose in the second trimester and over 20% accessed the first dose after 30 weeks gestation need attention if the expected impact of IPTp is to be made. Factors identified for poor access and compliance were lack of ANC attendance, late first ANC visit, irregular ANC attendance and inadequate health education. Irregular and late first ANC visits have also been identified by other studies as challenges to successful implementation of IPTp with SP (Guyatt *et al.,* 2004; van Eijk *et al.,* 2004; Mbonye *et al.*, 2007; Launiala and Honkasala, 2007). Factors earlier identified in Malawi as influencing timing of first ANC visit included the woman's desire to confirm pregnancy, cultural beliefs that discourage early disclosure of pregnancy, and distance from health facilities (Launiala and Honkasala, 2007). In the exploratory study of perception on malaria in pregnancy, reasons for patronizing ANC were also identified. Pregnant women patronized ANC because they wanted to know the position of their babies, availability of drugs and ill-health. Since malaria is mostly asymptomatic in adults in hyper-endemic areas, the women may only seek care when ill. Malaria preventive educational messages provided to these women early are likely to influence uptake of preventive measures. As expected, the midwives perceived that provision of adequate health education on ANC and IPTp, regular and early ANC attendance and the involvement of community health nurses in the administration of IPTp-SP during outreach clinics would improve access to and compliance with IPTp. At present health education is mostly given to pregnant women at ANC and to postnatal mothers at outreach clinics. This excludes non-pregnant women and non-nursing mothers. This latter group of women will not be well informed on IPTp to influence their decisions on the uptake of the intervention when they become pregnant. Community health education programmes are occasionally organized but these are inadequate to make enough impact on behavioural changes and there is the need to intensify it. Community health workers have also been found to be suitable in increasing awareness to programmes and compliance to health interventions (WHO, 2003). Involving the TBAs and CBSVs could be a complementary strategy in disseminating information on IPTp and other interventions for malaria in pregnancy. Providing them with appropriate educational messages for delivery in communities is likely to make an impact on malaria control in pregnancy. The idea of providing IPTp at outreach clinics by community health nurses is based on the assumption that when the service is brought closer to the community, travel time to established health facilities is reduced and this will translate into patronage of the service. It is however possible that some pregnant women who feel healthy and have very little or no knowledge on IPTp will not seek to access the intervention. There is therefore the need to link up with recognized community agents to sensitize and mobilize the women for patronage of the service. Community health agents are in every community in the Afigya Sekyere district. They support health professionals by organizing venues for outreach clinics in communities where they are held. They could be made responsible for identifying pregnant women early for IPTp. Non-existent and unreliable house numbers, coupled with inadequate number of health professionals have made home visits by health professionals inadequate and less effective as noted by the HCPs. The community health agents will be useful with this service since they live in the community. The activities of the community health agents in the implementation of IPTp will require supervision and monitoring which may be an added responsibility to the health professionals. It will also ~~require~~ extra financial commitment in terms of logistics, transport and incentive. However, the benefits of increasing access to and compliance with IPTp, reducing prevalence of parasitaemia, anaemia and LBW and early identification of pregnant women especially those at risk for health interventions will outweigh the cost. Their involvement would also enhance their record-keeping skills for effective monitoring of IPTp implementation to make impact on control of malaria in pregnancy.

Conclusions

Malaria in pregnancy is perceived by pregnant women, TBAs, CSBVs and opinion leaders in the Afigya Sekyere district as a major cause of illness during pregnancy. Malaria was rightly perceived to be caused by mosquito bites. ITN use was perceived by pregnant women as one of the malaria preventive measures and this perception was influenced by occupation, educational status, gravidity ANC attendance and frequency of ANC visit. However, only few of the pregnant women perceived malaria as one of the causes of anaemia with majority of them perceiving poverty as the main cause of anaemia. This perception was influenced by educational status. Birthweight distribution in the Afigya Sekyere district is influenced by parity, maternal age, locality, sex of infant and season of birth. Prevalence of LBW showed seasonal variation in its distribution and was high. Malaria parasitaemia and anaemia are serious problems in the Afigya Sekyere district. *P. falciparum* was the main infective malaria parasite species in the district. The risk factors for malaria were age and gravidity. Risk factors for anaemia were age, gravidity, gestational age and malaria parasitaemia. Adolescents and primigravidae have excess risk of developing anaemia compared to their older counterparts. IPTp administered through community health workers was effective in reducing malaria parasitaemia and malaria-associated anaemia in pregnancy and led to increased birthweight. The prevalence of parasitaemia and anaemia significantly reduced with increased number of doses of IPTp-SP. The study also demonstrated that IPTp administered through trained community health agents increased access and compliance in rural and deprived communities. The community health agents are therefore a valuable human resource whose efforts effectively complemented the work of health professionals. Access to and compliance with IPTp at the health facilities is low. Late first ANC visit, irregular- and non- ANC attendance were the contributory factors. The implementation of IPTp at outreach clinics by community health nurses is being proposed as a complementary delivery strategy, in addition to intensified health education and home visits. Community health agents are available in all communities and CBSVs support community health nurses in their outreach clinics. They can therefore be entrusted with the responsibility of early identification of pregnant women, providing health education, making follow-up home visits and administering IPTp in deprived communities.

Recommendations

Based on the findings of this study and above discussions and conclusions the following recommendations are suggested for implementation at:

1. National level

IPTp administered through CBI achieved comparable results with HFI and therefore suggests the potential of using community health workers to increase IPTp coverage especially to those in deprived communities. To increase IPTp coverage, there is a need for national policy on the integration of IPTp into home based management of malaria (HBMM) and also IPTp as an integral part of services delivered by community health nurses at outreach clinics. There is the possibility of drug misuse when IPTp is integrated into HBMM without adequate training, monitoring and supervision. Therefore regular training, monitoring and superversion are recommended. To esnsure adequate monitoring of IPTp within HBMM, there is a need to design simple IPTp register for community level use. HBMM staff also need to be well motivated.

2. Regional level

The Regional Health directorate (RHD) needs to monitor the delivery of IPTp and ensure adequate supply of SP to the districts. The RHD should ensure regular supply of health educational materials to the districts and monitor their use.

3. District level

The DHMT should ensure regular supply of SP to avoid periodic shortages at health facilities. The DHMT should also regularly supervise and monitor IPTp delivery at health facilities and at communities to avoid inappropriate dosing and drug misuse. DHMT should organize training for community health nurses on malaria, anaemia and IPTp. Regular training should also be organized for community health agents who will be involved in IPTp implementation in deprived communities. Community level administration of SP has cost implications e.g. transport costs and these should be noted and addressed. The DHMT should also ensure proper record keeping at all the health facilities in order to make assessment of IPTp coverage easier. The DHMT should institute a reward system for community health agents who identify women early in their pregnancy for IPTp and keep good records.

4. Health facility (subdistrict) level

Health education at ANCs need to be modified by midwives to appropriately link malaria and anaemia in pregnancy to enable pregnant women take the necessary preventive measures. Currently, most of the health education is provided mainly at ANC and on radios. The DHMT and sub-district health teams should liase with community health agents to organize and provide frequent community health education on malaria and anaemia, IPTp and other malaria interventions.

5. Community level

To improve malaria control in pregnancy, health education in the communities must be intensified aiming at decreasing perceived barrierers to behavioural change. Health education and promotion packages should target men and husbands since they are the main decision-makers for their households. The community health agents should sensitize community opinion leaders on the need for malaria control in pregnancy. They should also organize various groups such as women's groups, religious groups, youth groups etc. for health education and promotion on malaria control in pregnancy. They should also identify pregnant women early for IPTp, do follow up home visits to ensure compliance and keep records on the women. These reports should be regularly submitted to the DHMT. The DHMT should discuss with community opinion leaders appropriate ways of motivating the community health agents.

Proposed future studies

1. Pregnant women were not interviewed to elicit reasons for not accessing IPTp and non-compliance with the recommended doses. Further research is recommended on client perceptions of IPTp in the district.
2. Though health care providers were informed on community perceptions on malaria and anaemia in pregnancy in order to influence health education messages to the pregnant women, compliance at health facilities remained low. There is the need to investigate into health education approaches and to identify communication strategies that would enhance health behavioural change.
3. Resistance to SP is fast developing but studies have been mainly conducted in children. Studies to assess SP efficacy and suitability of other antimalarials in pregnancy would be useful.
4. Cost: Benefit analysis studies on integrating community IPTp with the Health facility IPTp are necessary to inform policy decisions on using community health agents for IPTp.

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APPENDICES

APPENDIX 1
KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCES, KUMASI, /DBL – INSTITUTE FOR HEALTH RESEARCH AND DEVELOPMENT, DENMARK

MALARIA IN PREGNANCY STUDY

CONSENT FORM

Study Woman's Identification Number

Name of Pregnant woman…………………………………………………

Age………………………

Address………………………………………………

Parity | 0 | 1 |

The study has been described to me and explained that I am volunteering for a research study on malaria control in pregnancy. It was explained that I would receive the usual recommended care during pregnancy and delivery based on Ghana Health Service standard protocols.

In this study I will receive Sulfadoxine-pyrimethamine (Fansidar) tablets beginning from 4 months of pregnancy.

I understand that this study is aimed at women of their first two pregnancies, and that I cannot participate if I am not able to tolerate Sulfadoxine-pyrimethamine (Fansidar).
I understand that the drug being used in this study has been tested. The drug has rare adverse effects and has been used in pregnancy without damaging the health of women or the babies.

During the study, I will have a number of examinations and laboratory tests similar to what is done at the Antenatal Clinic.

I understand I have the right to withdraw from the study at anytime.

I have been reassured that all information obtained from me as a result of this study will be confidential and used for the purposes of this research only.

……………………………………

Signature or Right Thumb-print
of Study Woman

Date

APPENDIX 2

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCES, KUMASI, /DBL – INSTITUTE FOR HEALTH RESEARCH AND DEVELOPMENT, DENMARK

MALARIA IN PREGNANCY STUDY

RECRUITMENT FORM

IDENTIFICATION NO.

Name of woman……………………………

Age………………………………………….

Address……………………………………

………………………………………………………………

Date……/……/…….

Gravida of Woman

0	1

Husband or next of kin …………………………

Number of children alive		
Number of children dead		
Number of abortions		

Date of last menstrual period

Unknown date (mark X)			………………………		

Educational Level

1. None	2. Primary
3. Middle/JSS	4. Secondary/Higher

Religion

1. Traditional	2. Christianity
3. Islam	4. Others …………………

Marital Status

1. Married	2. Single
3. Divorced	4. Widow

Occupation

1. Farmer/Housewife	2. Trader
3. Artisan	4. Others …………………

Pregnancy Test: P=positive; N=negative	

Mode of Recruitment

Midwife	TBA

	Yes	No
Hypersensitivity to SP		

Symptoms of Pregnancy

Symptoms	Yes	No
Enlarged breasts		
Nausea		
Vomiting		
Abdominal Pain		
Fatigue		

Socioeconomic indicators

	Yes	No
Radio in household		
Sleeps in Bed		
Sleeps on floor		
Number of inhabitants per room		
Pipe/Tap at home		
Latrine at home		
Motorbike in household		
Bicycle in household		
Car in household		
Uses ITN		

HB:

SLIDE TAKEN:

Entered by		

APPENDIX 3

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCES, KUMASI, /DBL – INSTITUTE FOR HEALTH RESEARCH AND DEVELOPMENT, DENMARK

MALARIA IN PREGNANCY STUDY

PERIPHERAL BLOOD LABORATORY - FORM

IDENTITY No. [| | | |]

Name of Woman ....

Age……………………………….. ....

Address ....

Gravida [|]

Last Menstrual Period ...../....../.......

Date Sample Taken [| | | | |]

Laboratory No. [| | |]

Name of Recorder ....

HEMOCUE RESULTS

Date [| | | | |]

Haemoglobin (g/l) [| |]

CERTIFIED CORRECT BY [|]

BLOOD FILM EXAMINATION

Date [| | | | |]

Malaria Parasites seen [1. Yes | 2. No]

Parasite count per 200 wbcs [| | | | |]

P. Falciparum (ASEXUAL) [| | | | |]

P. Falciparum (GAMETOCYTES) [| |]

P. Malariae [| |]

P. Ovale [| |]

P. Vivax [| |]

APPENDIX 4

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCES, KUMASI, /DBL – INSTITUTE FOR HEALTH RESEARCH AND DEVELOPMENT, DENMARK

MALARIA IN PREGNANCY STUDY

ANC VISIT FORM

IDENTIFICATION NUMBER | | | | | |

Name of Pregnant women:...

Date of Visit ...../...../.....

Age..............................

Parity of women (0 or 1)	

Address ....

When did you receive last antimalarial?. ...../..../

Symptoms of Pregnancy

Symptoms	Yes	No
Swollen breasts		
Nausea		
Vomiting		
Abdominal Pain		
Headache		
Fever		
Fatigue		
Back ache		
Baby movement		

Have you had fever in the past 7 days?

1. Yes	2. No	3. Don't know

If yes, have you been treated?	1. Yes	2. No
If Yes – what treatment		
Chloroquine		
Fansidar		
Herbal drug		

Other(Specify).................. ....

....

Adverse effects of Antimalarial

Nausea		
Vomiting		
Skin problems		
Eye problems		
Dizziness		
Itching		

CHECKED & CERTIFIED CORRECT BY DATE ...../......./......... | | |

APPENDIX 5

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCES, KUMASI, /DBL – INSTITUTE FOR HEALTH RESEARCH AND DEVELOPMENT, DENMARK
MALARIA IN PREGNANCY STUDY

DELIVERY - FORM

Identification Number | | | | | |

Name of Pregnant Woman ....

Age ....

Address ....

Mode of Recruitment

MIDWIFE	TBA

Date of Visit/Exam | | | | | | |

Name of Recorder ....

PLACE & TIME OF DELIVERY

Place of Delivery

1. Health facility	2. TBA
3. Home	4. Other

Date of Delivery | | | | | | |

Time of Delivery (GMT) | | | | |

Attendant at Delivery

1. Doctor	2. T-TBA	3. U-TBA
4. Midwife	5. Relative	6. Other

DELIVERY FINDINGS - MATERNAL

Did you have any complications during delivery?

1. PPH	2. Fits	3. Fever
4. None	5. Other	6.DK

Condition of Mother at time of exam

1. Very Good	2. Good
3. Fair	4. Poor

DELIVERY FINDINGS - NEWBORN

Is baby alive today? | 1. Yes | 2. No |

If No, was baby born alive? | 1. Yes | 2. No | 3. NA |

If No, was baby a stillbirth? | 1. Yes | 2. No | 3. NA |

Birthweight of newborn (kg) | | | . | |

Birth length (cm) | | | . | |

Head circumference (cm) | | | . | |

Chest circumference (cm) | | | . | |

Gestation | 1. Term | 2. Preterm |

Date of Birth | | | | | | |

Sex | 1. Male | 2. Female |

CHECKED & CERTIFIED CORRECT BY

DATE ...../......./......... | | |

APPENDIX 6

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCES, KUMASI, /DBL – INSTITUTE FOR HEALTH RESEARCH AND DEVELOPMENT, DENMARK
MALARIA IN PREGNANCY STUDY
PLACENTAL BLOOD LABORATORY - FORM

IDENTITY No. [| | | |]

Name of Woman ....

Age………………………………….. ....

Address ....

Gravida [|]

Last Menstrual Period ...../....../.......

Date Sample Taken [| | | | |]

Laboratory No. [| | |]

Name of Recorder ....

HEMOCUE RESULTS

Date [| | | | |]

Haemoglobin (g/l) [| |]

CERTIFIED CORRECT BY [|]

BLOOD FILM EXAMINATION

Date [| | | | |]

Malaria Parasites seen [1. Yes | 2. No]

Parasite count per 200 wbcs [| | | | |]

P. Falciparum (ASEXUAL) [| | | | |]

P. Falciparum (GAMETOCYTES) [| |]

P. Malariae [| |]

P. Ovale [| |]

P. Vivax [| |]

APPENDIX 7

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCES, KUMASI, /DBL – INSTITUTE FOR HEALTH RESEARCH AND DEVELOPMENT, DENMARK

MALARIA IN PREGNANCY STUDY

MISCARRIAGE - FORM

IDENTIFICATION NO. ☐☐☐☐☐

Name of Pregnant Woman ....

Age ....

Address ....

Last Menstrual Period ...../....../.......

Date of Visit/Exam ☐☐☐☐☐☐

Name of Recorder ....|......|......|.........

DETAILS OF MISCARRIAGE

Date of Miscarriage ☐☐☐☐☐☐

Estimated gestation (mths) ☐☐

Complications?

1. Yes	2. No	8. NA

Ask woman to give full details of events leading to miscarriage. (Write at the back)

If yes, what was the complication?

1. Bleeding	2. Preterm Membrane Rupture
3. Sepsis	4. Trauma
5. Other	

If you bled, how many days ☐☐

Did you have fever before miscarriage?

1. Yes	2. No	9. DK

Did you attend antenatal clinic before miscarriage?

1. Yes	2. No

CHECKED & CERTIFIED CORRECT BY

DATE ...../......./......... ☐☐

APPENDIX 8

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCES, KUMASI, /DBL – INSTITUTE FOR HEALTH RESEARCH AND DEVELOPMENT, DENMARK

MALARIA IN PREGNANCY STUDY

DRUG ADMINISTRATION FORM

IDENTITY NO. | | | | | |

Pregnancy (1 or 2)	

Name of woman……………………………

Age…………………

State any complaints……

Address……………………………………

Drugs given by

Midwife	TBA

Blood sample taken?

Yes	No

Date blood sample taken……/……./…...

APPENDIX 9

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCES, KUMASI, /DBL – INSTITUTE FOR HEALTH RESEARCH AND DEVELOPMENT, DENMARK

MALARIA IN PREGNANCY STUDY

ADVERSE REACTION FORM

IDENTITY | | | | | |

Pregnancy (1 or 2) | |

Name of woman …………………………………… Address……………………..

Date adverse effect first noted …………../………./……….

Tick adverse effects reported by woman

Gastrointestinal	Nausea
	Vomiting
	Diarrhoea
	Constipation
Neurological	Headache
	Funny or scary dreams
	Dizziness
Dermatological	Itching
	Spots on skin
Ocular	Bad sight
	Itchy eyes
Musculo- Skeletal	Joint ache
	Swollen joints
	Fatigue
General	Pain
	Fever

Specify action taken by woman after noticing adverse effect…………………………………………………………

……

Date of reporting……./……../…….

Write additional information on adverse effect on the back of this form.

CCB Date……./……../……..

APPENDIX 10

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCES, KUMASI, /DBL – INSTITUTE FOR HEALTH RESEARCH AND DEVELOPMENT, DENMARK

MALARIA IN PREGNANCY STUDY

MONITORING ANC ATTENDANCE

Name of Health Facility: Date…../…../…..

Month:

ID	Name of pregnant woman	Village	Date of attendance	Drugs given			Referred? Y/N
				IPT	Routine	Others	

APPENDIX 11

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCE, KUMASI, /DANISH BILHARZIASIS LABORATORY, DENMARK MALARIA CONTROL IN PREGNANCY STUDY

INTERVIEW WITH PREGNANT WOMEN

Place of interview: 1. Health Facility
2. Community

Time of Interview
Interviewer's code

If Health facility, indicate which

Health facility	Tick
Agona Hospital	
Kona Health Centre	
Jamasi Health Centre	
Asamang Hospital	
Wiamoase Sal. Army Hospital	
Baomang Health Centre	
Tetrem Health Centre	
Afamanso Maternity Home	
Kyekyewere Health Centre	
Ahenkro Health Centre	

BACKGROUND INFORMATION

1. Community………………

2. Age………….

3. Parity

0	
1	
2	
3	
4	
More than 4	

4. Gestation (Months)…………..

5. Marital status
a. Single c. Divorced
b. Married d. Widowed

6. Education
a. None c. JSS/Middle Sch.
b. Primary d. Secondary/Higher

7. Occupation
a. Farmer d. Govt. worker
b. Trader e. Unemployed
c. Artisan f. Other (specify)

8. Religion
a. Traditional c. Islam
b. Christianity d. Other (specify)…………

9. Socioeconomic indicators

Indicator	Yes	No
Access to tap water at home		
Latrine at home		
Uses ITN		
Motorbike in household		
Vehicle in household		

ANTENATAL ATTENDANCE AND DELIVERY

10. Do you attend ANC? 1. Yes 2. No

11. If Yes, how often? Check ANC Card

No. of Visits	Tick
1	
2	
3	
4	
More than 4	

12. If No, give reason
a. Health facility too far b. Lack of money
c. Don't feel sick. d. Unfriendly attitude of health staff
e. Long waiting time f) Other (specify)

13. How far is the facility from your home?
a. Less than 5Km c. More than 10 Km
b. 5 – 10 Km

14. In your community, where do pregnant women deliver?
a. Health Facility c. Herbalist
b. TBA d. Other (specify)

15. Where will you like to deliver?
a. Health Facility c. Home
b. TBA d. Herbalist e. Other (specify)

16. Why will you like to deliver there?

………………………………………

………………………………………

MALARIA IN PREGNANCY

17. What are the diseases pregnant women suffer from?
a. Stomach ache
b. Waist pains
c. Anaemia
d. Malaria
e. Other (specify)

18. How does one get malaria?
a. Staying in the sun
b. Eating oily foods
c) eating starchy foods
d) Mosquitoes
e) Unclean Environment
f) Other (specify)

19. What signs and symptoms will indicate that a pregnant woman has malaria?
a. Headache
b. Fatigue
c. Nausea
d. Vomiting
e. Difficulty in breathing
f. Paleness
g. Loss of appetite
h. Fever
i. Other (specify)

20. When a pregnant woman get malaria where do they go for treatment?
a. Chemical shops
b. Drug peddlers
c. Health facility
d. Traditional Birth Attendant (TBA)
e. Herbalist
f. Self treatment

21. What treatment is given a pregnant woman who has malaria?
a. Herbal preparation
b. Enema
c. Paracetamol
d. Chloroquine
d. Fansidar
d. Prayers
e. Other (specify)

22. How can malaria be prevented?
a. Weeding surroundings
b. Desilting gutters
c. Use of mosquito net, coils, sprays
d. Burning of herbs
e. Malaria prophylaxis

23. If a pregnant woman with malaria is not treated, what effect will it have?
a. Small babies
b. Anaemia
c. Abortion
d. Stillbirth
e. Premature delivery
f. Low birthweight baby
g. Other (specify)

ANAEMIA IN PREGNANCY

24. How can you recognize a pregnant woman with anaemia
a. Loss of appetite
b. Looking pale
c. Fatigue
d. Difficulty in breathing
e. Weight loss
f. Other (specify)

25. How can a pregnant woman prevent anaemia?
a. Eating balanced diet
b. Taking folic acid and iron
c. Enema
d. Using herbal preparations
f) Other (specify)

THANK YOU

APPENDIX 12

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, SCHOOL OF MEDICAL SCIENCE, KUMASI, /DANISH BILHARZIASIS LABORATORY, DENMARK MALARIA CONTROL IN PREGNANCY STUDY

INTERVIEW GUIDE FOR TBAs, CBSV, OPINION LEADERS

Place of interview..........................
Interviewer's code...............

Time of Interview......................
Interviewee status: a. TBA b. CBSV/VHC c. Opinion Leader

1. In your community, where do pregnant women have antenatal care?
a. Health facility b. TBA
c. Herbalist d. Other (specify)

2. Where do pregnant women deliver?
a. Health facility b. TBA c. Herbalist d. Other (specify)

3. Why do they deliver at such places?..

MALARIA IN PREGNANCY

4. What are the diseases pregnant women suffer from?
a. Stomach ache b. Waist pain
c. Anaemia d. Malaria e. Other (specify)

5. How does one get malaria?
a. Staying in the sun b. Eating oily foods
c. Eating starchy foods d. Mosquito bites
e) Unclean environment f. Other (specify)

6. What signs and symptoms will indicate that a pregnant woman has malaria?
a. Headache e. Difficulty in breathing
b. Fatigue f. Paleness
c. Nausea g. Loss of appetite
d. Vomiting h. Fever
j. Other (specify)

7. When a pregnant woman gets malaria where do they go for treatment?
a. Chemical shops b. Drug peddlers
c. Health facility d. Traditional Birth Attendant (TBA)
e. Herbalist f. Self treatment

8. What treatment is given a pregnant woman who has malaria?
a. Herbal preparation e. Fansidar
b. Enema f. Prayers
c. Paracetamol g. Other (specify)
d. Chloroquine

9. How can malaria be prevented?
a. Weeding surroundings
b. Keep gutters clean
c. Use of mosquito net, coils, sprays
d. Burning of herbs
e. Malaria prophylaxis
f. Other (specify)

10. What effect will malaria have on a pregnant woman an the baby?
a. Anaemia b. Stillbirth c. Abortion
d. Premature delivery e. Small baby f. Other (specify)

ANAEMIA IN PREGNANCY

23. What symptoms will indicate that a pregnant has anaemia?
a. Loss of appetite d. Difficulty in breathing
b. Looking pale e. Weight loss
c. Fatigue f. Other (specify)

24. What should a pregnant woman do to prevent anaemia?
a. Eating balanced diet
b. Taking folic acid and iron
c. Enema
d. Using herbal preparations
f) Other (specify)

THANK YOU