

SCHOOL OF PUBLIC HEALTH, COLLEGE  
OF HEALTH SCIENCES, UNIVERSITY OF  
GHANA-LEGON

FACTORS ASSOCIATED WITH YAWS IN  
THE GA WEST DISTRICT OF GHANA  
(A CASE-CONTROL STUDY AT OBOM)

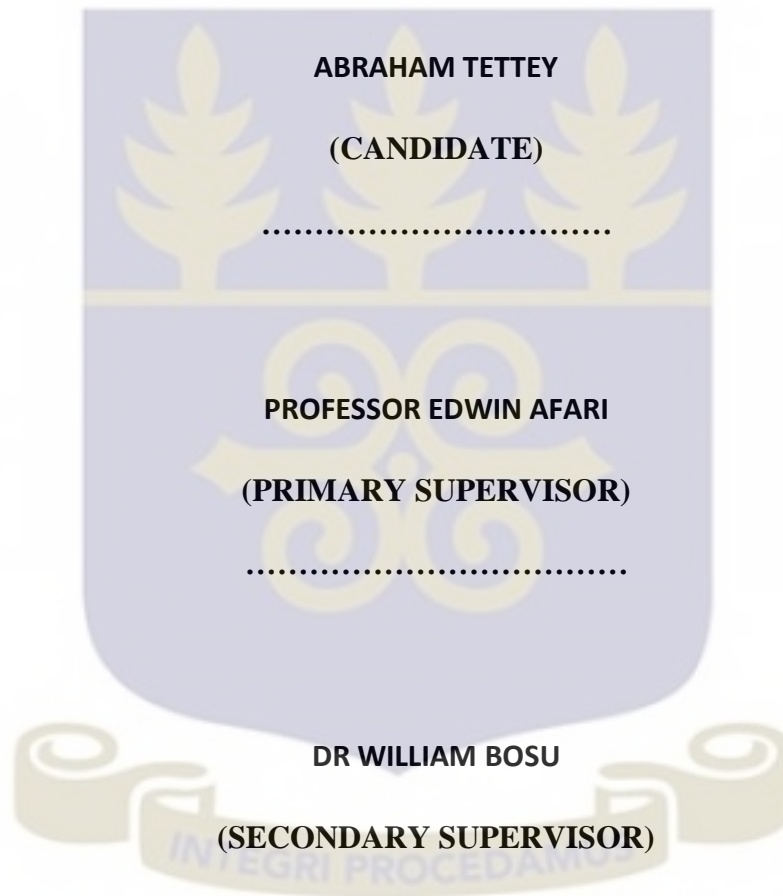
**BY ABRAHAM TETTEY**

**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT FOR THE AWARD  
OF MPH EPIDEMIOLOGY AND DISEASE CONTROL DEGREE.**

**AUGUST 2009**

## DECLARATION

I hereby declare that, apart from references from books and relevant literature which have been duly acknowledged, this dissertation is a result of my own research work carried out under the supervision of Professor Edwin Afari, Dr. William Bosu and Dr. Cynthia Kwakye-Maclean.



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## DEDICATION

I dedicate this work to all research fellows and any future research that will use information from this work to make its findings more appreciable.



## ACKNOWLEDGEMENT

I wish to acknowledge Professor Edwin Afari, Dr. William Bosu and Dr. Cynthia Kwakye-Maclean whose careful supervisory roles helped shape this project work.

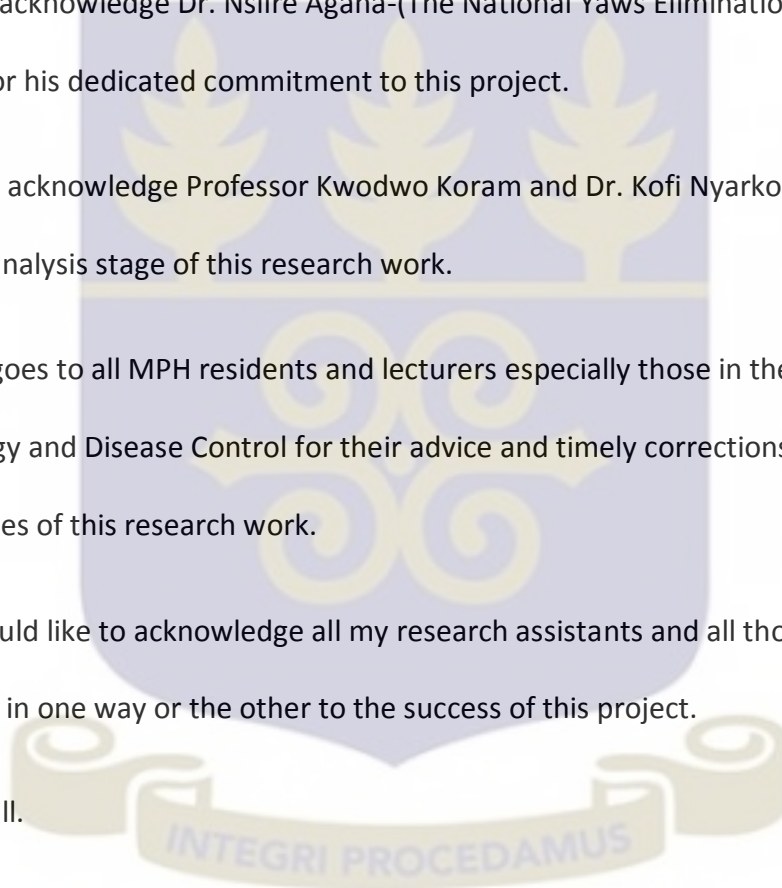
Secondly, I acknowledge Dr. Nsiire Agana-(The National Yaws Elimination Programme Manager) for his dedicated commitment to this project.

I would also acknowledge Professor Kwodwo Koram and Dr. Kofi Nyarko for their inputs during the analysis stage of this research work.

My thanks goes to all MPH residents and lecturers especially those in the Department of Epidemiology and Disease Control for their advice and timely corrections made during various stages of this research work.

Finally, I would like to acknowledge all my research assistants and all those who contributed in one way or the other to the success of this project.

Thank you all.



## ABSTRACT

**Background Information**-Yaws is an important public health problem and an obstacle to socio-economic development. The disease causes gross destruction of the skin, bones and joints especially in children below 15 years. The study was carried out to determine factors associated with the disease among children less than 15 years of age in the Ga west district.

**Method** - A total of 120 cases and 120 age matched controls were included in the study. Data were collected on sex, hygienic practices, food consumption and socio-economic status of households. A case was defined as a child less than 15 years of age living in the Ga West District for at least three years, who had classical signs of yaws disease such as papillomata which may or may not have undergone ulceration or painful papillomata and hyperkeratosis of the palm and soles. A control on the other hand was any healthy child less than 15 years of age living in the Ga West District for the past three years or longer, who neither had yaws nor a skin lesion.

**Results** -Compared with control subjects, case patients were more likely to have slept in the same room with four or more other relatives (MOR): 2.2, 95% CI: 1.2-4.1), and to have low income earning fathers (MOR): 5.00, 95% CI: 2.9-10.6). Bathing at least twice a day seems to be protective of the disease (MOR): 0.33, 95% CI: 0.13-0.83) and consumption of fruits in addition to regular diet was also protective (MOR): 0.17, 95% CI: 0.05-0.42).

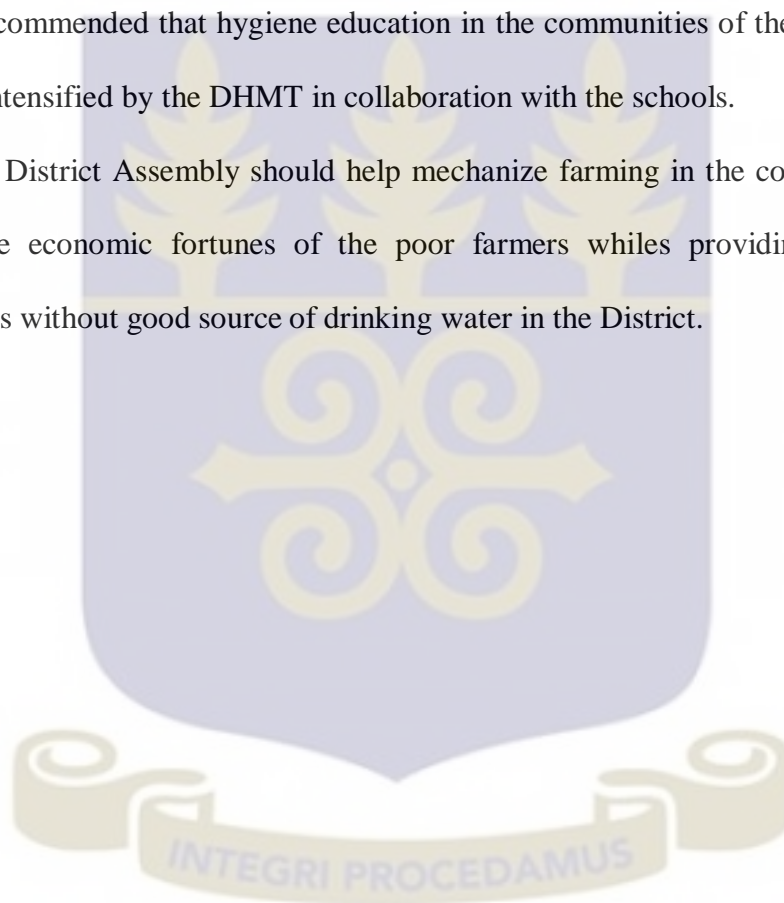
Having a personal towel as opposed to sharing towels with relatives also seems to be protective of yaws (MOR): 0.17, 95% CI: 0.09-0.32). Living in a house with more than two rooms was protective of the yaws disease (MOR 0.42 95% CI: 0.21-0.93) while fetching water from dams as opposed to bore holes was positively associated with the disease {(MOR 1.29 95% CI (1.03-2.81) p=0.033}

**Conclusion and Recommendation-**Of all the risk factors examined, father's income seems to have the strongest association with the prevalence of yaws. This was followed by the number of rooms in a house and regular fruit consumption. Sourcing water from a bore-hole and bathing always with soap were also found to be protective of yaws.

It is recommended that the school feeding programme in the Ga West District should consider including fruits in their daily servings of meals to school children.

It is also recommended that hygiene education in the communities of the Ga West District should be intensified by the DHMT in collaboration with the schools.

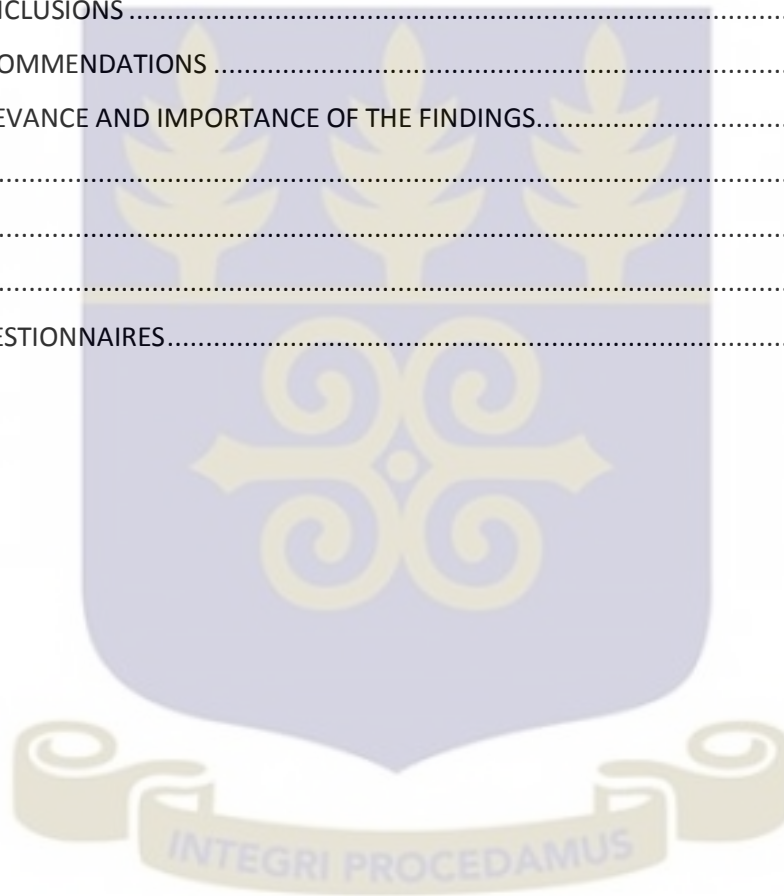
Finally, the District Assembly should help mechanize farming in the communities to help improve the economic fortunes of the poor farmers while providing bore-holes for communities without good source of drinking water in the District.



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## LIST OF ACRONYMS



CDC	Centre for Disease Control- USA
CHPS	Community based Health Planning Services program
DCU	Disease Control Unit
DHMT	District Health Management Team.
GHS	Ghana Health Service
MOH	Ministry Of Health
MPH	Master of Public Health
NTP	National Tuberculosis Programme
UNICEF	United Nation International Children Educational Fund
USAID	United States Agency for International Development
WHO	World Health Organization

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 BACKGROUND INFORMATION

Yaws is a disease caused by the spiral-shaped bacterium (spirochaete) *Treponema pertenue*. It is a contagious, non-venereal infection in humans that presents mainly in children below 15 years. It is an infection of the skin, cartilage and bone. If untreated, it can stay for several years and cause deformities in the face, limbs and joints, leaving ugly scars on any part of the body (Fernando et al 2006; National Yaws Control Programme 2008).

The disease occurs primarily in poor, rural and marginalized populations in parts of Africa, Asia and South America, where conditions of overcrowding, poor water supply, poor sanitation and lack of personal hygiene prevail (National Yaws Control Programme 2008).

Thus, it is a poverty-related disease. It is aptly said that, “Yaws begins where the road ends” (Fernando et al 2006). The disease occurs primarily in warm, humid, tropical areas of Africa, Asia, South America, and Oceania, among poor rural populations where conditions of overcrowding and poor sanitation prevail.

The control of yaws requires the joint efforts of community members and health personnel. *Treponema pertenue* has been generally recognized as the causative agent of yaws. Since 1900, there has been great reduction in the incidence of yaws but no eradication has been achieved. There was a global control program of yaws in 1948 involving many governments with assistance from WHO and UNICEF. In many of these countries, eradication appeared to have been achieved. Since the 1970s and 1980s, there has been a resurgence of the disease in sub-Saharan Africa, western pacific, south-east Asia and other

parts of the world (Agadzi & Aboagye-Atta 1983). This resurgence can be attributed to the continuing or increasing poverty of many rural and urban slums population with attendant lack of personal hygiene and the neglect of well-established principles of yaws control such as active case finding and treatment of cases and contacts with benzathine penicillin. (Ashitey 1994).

Yaws has been endemic in Ghana for generations. It was among the first diseases for which western treatment was available in the Gold Coast. Yaws was the first disease to be researched on by a Gold Coast doctor. Dr Charles Elias Reindorf, the medical officer of health in the Akwapim District of the Eastern region, in 1927 presented a thesis on yaws to the Durham University in the UK to obtain a doctorate in medicine (Ashitey 1994).

Yaws is an important public health problem and an obstacle to socio-economic development. The secondary and tertiary form of the disease especially plantar yaws were serious impediment to farmers as well as a high rate of absenteeism among school children. This was due to pain and disfigurement. Efforts have been made to control the disease without success. The incidence drops after each successful mass campaign. Shortly afterwards the incidence increases again. (Adams 2001; GHS/MOH 2000)

WHO and UNICEF assisted Ghana's anti-yaws mass campaigns between 1957-1961. This reduced the prevalence rate from 10-15% in some places (including Greater Accra) to 0.5% and in almost all parts of the country except Central and Western Regions which were the last to start the campaign (GHS/MOH 2000).

Based on the low rates recorded after the mass campaign, especially the records of 1969, it was concluded that the disease no more posed a public health threat (WHO 1982).

It was assumed that the general health service would be able to continue with the control of the disease. Some countries prematurely delegated surveillance activities to the static rural health service, which often have no adequate training for the new task. Deteriorating economies of African countries led to the shift of health care resources to the control of other diseases with higher morbidity such as malaria, the six childhood killer diseases and cholera (WHO 1982). The delegation of surveillance activities to the static rural services also resulted in passive case recording as against the successfully used active case finding during the mass treatment in the 1960s. These factors were said to be responsible for the re-emergence of yaws in the West Africa, Central Africa and South East Asia (WHO 1982).

The persistent foci of yaws in Ghana in this 21st century should be considered unacceptable in view of the availability of a simple, safe and cost-effective intervention— a single intra-muscular injection of long-acting benzathine penicillin that needs to be given to the patient and all his/her close contacts (Fernando et al 2006).

## **1.2 STATEMENT OF THE PROBLEM**

The yaws cases in Ghana and the Ga West district have been on the increase for sometime now and there is no data on risk factors associated the disease.

In 1980, the number of yaws cases in Ghana was 71,765 (GHS/MOH 2008). This was reduced to 45,568 in 1981 due to active case search and treatment of cases and contacts with a single injection of benzathine penicillin. With sustained efforts the number of yaws cases was reduced to 4375 in 1983 and the disease was almost eliminated as a result of mass penicillin treatment campaign (GHS/MOH 2008). With low numbers of yaws cases, the yaws programme was integrated into primary health care which was generally weak in

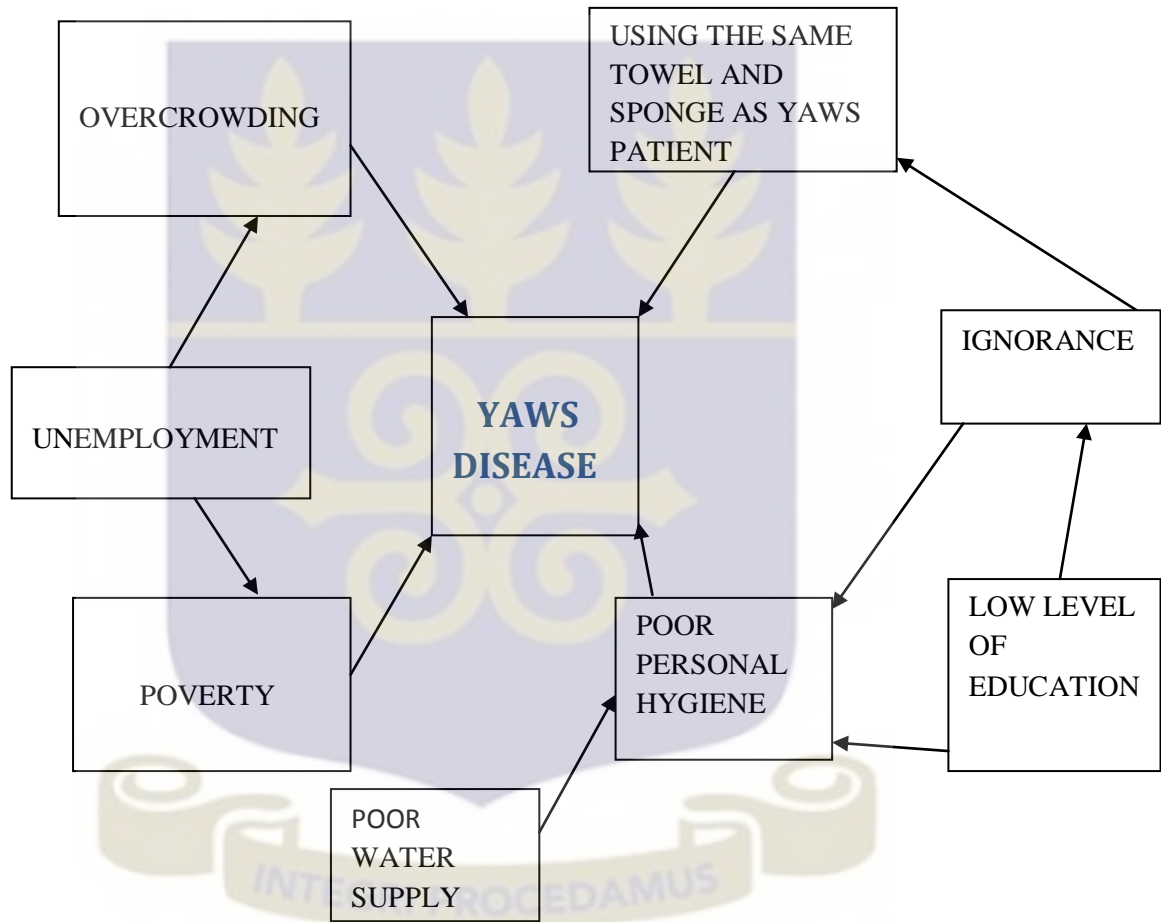
the implementation the activities of the yaws programme (GHS/MOH 2008; NTP/YCP 2007; Ashitey 1994).

With the disease no longer being perceived as a priority by national health policy-makers, the number of cases rose from 4,375 to 58,519 between 1983 and 1997. This was of great concern since treatment for the disease is readily available and the disease can easily be brought under control (GHS/MOH 2000; GHS/MOH 2008).

The situation at the Ga West district is not any different as the prevalence of yaws increased from 10 cases per 100,000 population in 2006 to 14 cases per 100,000 population in 2007 (District annual report 2008). These however are reported cases and the actual number cases could even be higher. A field survey conducted in 1993 by the National Yaws Control Programme in some selected districts in Ghana found out that only 30% of cases were being reported (GHS/MOH 2000).

The rapid rise in the cases of yaws in the country has been a concern for the ministry of health as the disease can easily be eliminated. As a result in 2001 the yaws control programme was revived with a sole aim of seeing to the elimination of the disease by 2012 (National Yaws Control Programme 2008; NTP/YCP 2007; Otchere 1999).

### CONCEPTUAL FRAMEWORK



**FIGURE 1**

### **1.3 RATIONALE FOR THE STUDY**

Yaws is a debilitating disease common in children under 15 years. It can cause gross destruction of the skin, bones, and joints. This can cause deformities of the legs, nose, palate, and upper jaw. The disorder is crippling if untreated. Approximately 10% of the people with yaws will develop widespread tissue damage (National Yaws Control Programme 2008; Otchere 1999). Yaws control in Ghana and Ga west district has been ongoing for sometime now. Considering the efforts made by the Ministry of Health in terms of resources and man-power in the control of the disease, one would have expected a zero reporting of cases of yaws by this time (National Yaws Control Programme 2008; WHO 1982). Unfortunately, this is not so. This is because of the neglect of well-established principles of yaws control such as active case finding and treatment of contacts (WHO 1982). Feasible interventions to treat, prevent and control yaws will require a broad understanding of the determinants of the disease.

In Ghana prevalence studies on yaws has been carried out by Dr. Yaw Otchere in 1999. His findings revealed a prevalence of 16% of yaws in the Assin district of the Central Region. However there have not been studies on the determinants of yaws in the Central nor Greater Accra regions of Ghana. This study on the risk factors for yaws is timely to provide useful information on such determinants to inform policy. Again knowledge of risk factors for yaws would be useful in designing education and treatment components for yaws control program in the Ga West district.

## **1.4 STUDY OBJECTIVES**

### 1.4.1 General Objective

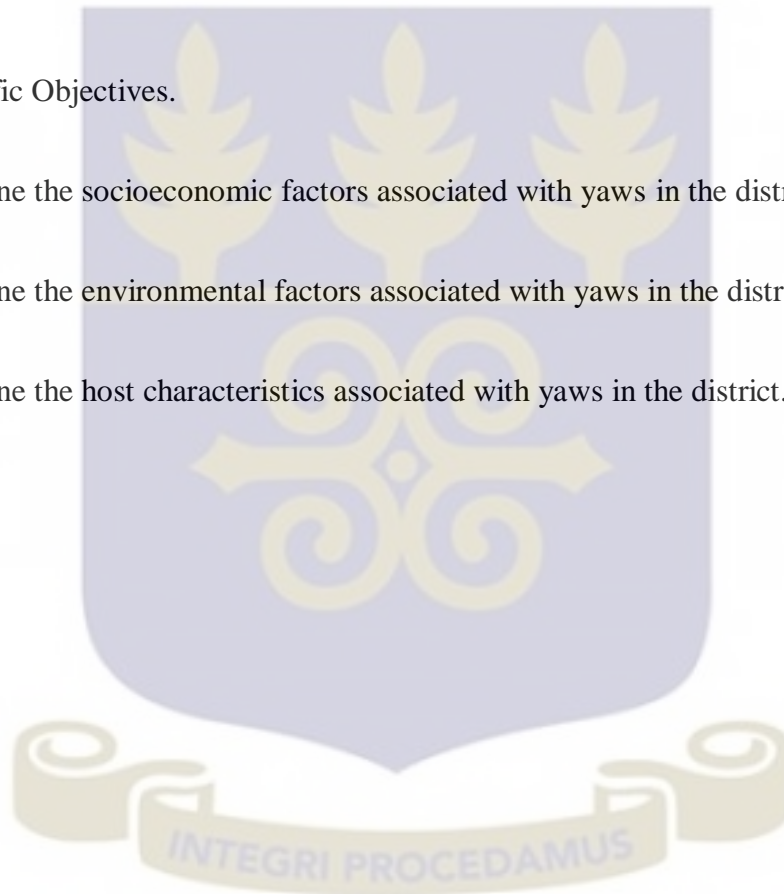
To determine factors associated with yaws among children less than 15 years of age in the Ga West district.

### 1.4.2 Specific Objectives.

.To determine the socioeconomic factors associated with yaws in the district.

.To determine the environmental factors associated with yaws in the district.

.To determine the host characteristics associated with yaws in the district.



## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 EPIDEMIOLOGY OF YAWS

Yaws is an infection of the skin, cartilage and bones caused by the bacteria, *Treponema pertenue*. If untreated, it can stay for several years and cause deformities in the face, limbs and joints leaving ugly scars on any part of the body (National Yaws Control Programme 2008).

The infection is transmitted from one person to another by direct skin to skin contact with materials from infectious lesions. The presence of cuts and abrasions and possibly flies settling on moist lesions facilitate the spread of the disease. The treponema cannot penetrate intact skin (WHO1982).

In Ghana, yaws occurs almost equally all year round but there may be hidden seasonal variations because of incomplete and inconsistent data (National Yaws Control Programme 2008).

The disease is characterized by highly contagious primary and secondary lesions and non-contagious tertiary/late destructive lesions. Within two to eight weeks of infection the lesion known as mother yaws or primary yaws appears in the form of a granulomatous ulcer at the point of implantation of the spirochaetal infection on the face or extremities, usually the leg. The primary yaws is painless unless it is secondarily infected. There is also an enlargement of regional lymph glands which usually accompany the appearance of the primary yaws but they usually disappear several weeks later. The primary yaws lesion

(mother yaws) proliferates slowly and may form a framboesial (raspberry) lesion or undergoes ulceration. A patchy erythematous rash follows the mother yaws after a variable period of latency and ushers in the secondary yaws, which is the common characteristic form of the disease found mainly in children below 15 years of age. A typical lesion is a multiple papular and granulomatous eruption that can cover any part of the body. In dryer climate however they may be confined to the moist parts of the body such as the armpits, the nasal cleft and the peri-anal areas (National Yaws Control Programme 2008; WHO1982).

In recent times however yaws has been classified into two categories namely early yaws and late yaws. Lesions that may present during early yaws include:

Papillomata- One or many yellowish, hard, painless 'boils' with dark discharging yaws germs. They may join into rings like ringworm.

Ulcerated papillomata- Ulcers with raised yellowish edges, yellowish discharge and ulcer base not fixed. Cracks, fissures, pits and ulcers on palms and soles. Large lesions with shallow ulcers around anus.

Hypo-pigmented macular lesions- Rashes that are pale, flat or raised and painless. They may join into large patches or rings.

Polydactylitis- Swollen, painful fingers especially in children.

Sabre tibia- Swollen painful tibia or other long bones.

Nodules and ganglia occasionally on the wrists and elbows.

The late yaws lesions are generally non-infectious and they include:

Dry crab yaws- Painful thickenings of palm and soles. Farmers are not able to farm while school children find it difficult to walk to school.

Gangosa- This refers to deformed face caused by the destruction of the bones in the nasal cavity.

Gondou- This refers to deformed face that may obstruct breathing and sight.

Destructive lesions of the skin and bone characterize tertiary or late yaws and they occur in about 10-20% of untreated patients, usually 5 or more years after infection. Healing is accompanied by extensive scarring and where joints are involved there may be debilitating contractures (Yaws training manual 2008; Otchere 1999).

## **2.2 FACTORS ASSOCIATED WITH YAWS**

### **2.2.1 Environmental Factors**

Yaws is a water washed disease that is brought about as a result of inadequate bathing with soap and water due to the unavailability of water. Poor personal hygiene and overcrowding are factors that contribute to the spread of the disease. In overcrowded houses especially where there are many children sharing the same bed, the disease spreads by direct contact from one child to another and through sharing of clothes, handkerchiefs, towels and pillows (Gaynor et al 2003; Katz et al 1996). Furthermore, poor sewage and garbage disposal in the community and the lack of latrines in households contribute

significantly to the spread of the disease. It has been shown that yaws incidence increases as the sanitary conditions of the home decreases (Hill R 1953).

It has also been found that yaws is a rural disease rarely found in urban areas (Hill R 1953). The incidence of yaws in the age-group 10-14 was 50% in the country areas and 26% in the town areas although the standard of sanitation and hygiene were about the same. The authors concluded that the difference in incidence may be due to the fact that in the country areas(villages), there are extensive areas of vegetation(bush) which increase the chances of injury to the legs and feet and therefore of liability to infection (Hill 1953).

### 2.2.2 Socio-economic Factors

Yaws appears to be endemic where the standard of living is low and where there is overcrowding and lack of proper sanitation and facilities for proper personal hygiene; these circumstances are the same for any contagious disease. It has been found that yaws is more prevalent among the lower social classes of society than among the higher (Hill 1953). One reason for this is that wearing of shoes is much more common among the higher social classes and they are better clothed than the lower social classes. An interesting example of the protective effect of footwear was given in Burma when the Eighth West African Division retreated from the Arakan in 1944. The soldiers found boots too heavy so they threw them away; the monsoons were starting and an epidemic of foot-yaws ensued (Hill 1953).

It is evident that yaws declines with the rise in socio-economic status—that is to say, when more clothing and footwear are worn, when the standards of personal hygiene and sanitation are more rigorous, and when houses have covered floors and enough rooms to eliminate overcrowding conditions (Turner et al 1951).

### 2.2.3 Host-related Factors (diet)

The connection between dietary deficiency and yaws-incidence is not apparent. It is known that dietary intake such as low protein-intake and avitaminosis are common in the tropics, but whether or not a dietary deficiency makes a patient more prone to yaws infection is not known (Turner et al 1951). In investigations of 280 children under the age of puberty in a village in the Gold Coast, Findley found that only 3.8% of the 233 children without yaws showed signs of avitaminosis, where as 14.8% of the 47 children showing lesions of yaws had marked signs of avitaminosis (Hill 1953).

Chambers brings out the fact that in general inhabitants of areas in which yaws is endemic are underfed; he points out however, that inhabitants of such areas are better-off agriculturally than the “rain-starved” areas where both yaws and agricultural activities are limited because of poor rainfall and pervious soils (Chambers, 1938).

It has been stated that yaws is more common among the pastoral Nilotic tribe of Anglo-Egyptian Sudan than among the Agrarian Zande. The former can be regarded as “blood and milk” eaters where as the latter are vegetarians. He suggests the difference in the incidence of yaws may be due to diet; but there are several factors at play in two such widely different groups (Hill 1953).

## **2.3 DISTRIBUTION OF YAWS**

### **2.3.1 Distribution by place**

Reports from the National Yaws control Programme indicated that yaws predominantly prevalent in the remote rural areas in Ghana is now spreading to peri-urban fringes of metropolitan areas and other large towns. Yaws cases have been reported in some parts of Accra (Hill 1953; GHS/MOH 2008).

This observation was also reported after the last initial treatment survey in 1983. It was noted that, as in the past yaws, which was particularly prevalent in more remote rural areas of Southern Ghana, could now be found in the major urban areas such as Accra and Kumasi (Hill 1953; GHS/MOH 2008).

A study done in suburban areas in Jamaica in 1977 indicates that the disease can be imported by the movement of infected patients from other areas and it may spread if conditions are favourable (Green, 1977). Favourable conditions that facilitate the spread of the disease include overcrowding, unhygienic and moist conditions. This explains the increase of incidence of yaws in the rainy season (National Yaws Control Programme 2008; Otchere 1999).

### **2.3.2 Age and sex distribution**

Yaws is very rare before the age of 18 months and the peak of the onset of the disease is between two and five years. The prevalence of the disease increases with age (Turner et al 1935). It has also been established that yaws after two years of age occurs more in the male than the female (Turner et al 1935; Chambers 1938).

In one series of 641 cases seen with primary lesions 372 were males while 269 were females. The majority of cases were between 5-14 years of age, and the explanation given is that boys are more active than girls and therefore suffer more traumata; further, girls of school age are usually better clothed than boys of the same age and this is possibly a protective factor which would tend to reduce the incidence in the female (Turner et al 1935).



## CHAPTER THREE

### 3.0 METHODS

#### 3.1 STUDY DESIGN

It was an age matched case-control study. Every case was individually matched to a control of the same age. The cases were not matched for sex because it was a variable.

#### STUDY AREA



**FIGURE 2**

The study area was the Ga West District. The Ga West Administrative District is one of the 10 districts that make up the Greater Accra Region in the south of Ghana. In the year 2004

the Ga West district was carved out of the erstwhile Ga district which was created in 1988 in pursuance of the government's decentralization and local government reform policy. In June 2008 the district was further split into the Ga West and South districts (DHD/DHMT 2008). About 60% of the communities in the district are rural and scattered while the remaining 40% is made up of urban and peri-urban communities which are densely populated. The district shares boundaries with the Ga South district to the west, Akwapim South district to the north, Accra Metropolis to the south-east and the Ga East district to the east. The natural resources in the district are numerous water bodies with the biggest being the Densu River which was dammed and is the only water supply to the western part of Accra. These water bodies are significant for economic activities as well as disease causation.

A number of water related diseases such as yaws and buruli ulcers are endemic in the district (DHD/DHMT 2008). The district has a population of 183,436. The number of children under 15 years is 40,521. The District also has one government hospital, thirteen private hospitals/clinic, four community clinics and three CHPS (Community based Health Planning Services programme) zones. Apart from malaria, skin diseases including yaws and ulcers were the most commonly reported diseases in the district (DHD/DHMT 2008).

## 3.2 VARIABLES

### *Dependent variable*

*Disease status of respondent was our dependent variable.*

### *Independent variables*

*Under socio-economic factors, we looked at variables such as occupation, educational attainment and income of the children's care-givers. Questions were also asked on household possessions such as radios, television sets and motor bikes to help us determine the socio-economic status of these households.*

*Environmental variables examined included source of water, distance from source of water, number of people per room, type of house and number of rooms per house among others.*

*For host characteristics, the study looked at the effects of a child's sex, his/her bathing habits (personal hygiene) and eating habits on the outcome variable.*

## 3.3 SAMPLING

### 3.3.1 Study Population

Inclusion criteria: The study population included all children below 15 years of age and their care givers who were residing in the Ga west district at the time of the study.

Cases: A case was defined as a child less than 15 years of age living in the Ga West District for at least three years, who had classical signs of yaws disease such as papillomata which

may or may not have undergone ulceration or painful papillomata and hyperkeratosis of the palm and soles.

Controls: A control on the other hand was any healthy child less than 15 years of age living in the Ga West District for the past three years or longer, who neither had yaws nor a skin lesion.

### 3.3.2 Sample Size

We recruited an estimated 120 cases and an equal number of controls to achieve a power (1- $\beta$ ) of 80%; to detect an odds ratio of 2.5 at the 5% significant level, if 16% or more of the study population of Ga west district were exposed to the disease (Otchere 1999).

### 3.3.3 Sampling Procedure

Forty communities in the Obom sub-district of the Ga West District had reported of yaws cases. Out of these twenty communities were selected at random for the case search. On selection of controls, the four cardinal points namely north, south, east and west were written on pieces of paper and tossed in a bowl. One was selected. All the houses facing the direction selected in relation to the house of a case were sequentially numbered. The numbers were written on pieces of paper and tossed around in a basket. One house was randomly selected from the basket of numbers. This house was visited to locate an age matched control for the case. If the children in the house did not meet the criteria, another house is selected from the basket of numbers until a matched control was obtained for the case. Where more than one control met the criteria one was randomly selected.

### **3.4 DATA COLLECTION TECHNIQUE AND TOOLS/INSTRUMENTS**

#### **3.4.1 Data collection technique and tools**

Care-givers of children who were identified as cases and controls were interviewed using a structured questionnaire. The questionnaire was structured to elicit information about the characteristics of the household head, the community and the respondent. Clinical observations were made in the detection of cases.

#### **3.4.2 Training Interviewers**

Six research assistants were recruited with the aid of the District Health Directorate. They were trained for two days to understand the questionnaire and made to translate the questionnaire to a neutral person in their native language. This person was then asked to translate the questionnaire to English to assess whether the questions were well understood as intended.

#### **3.4.3 Pretesting and review of instruments**

Pretesting of data collection tools was done in one community (one of sub-districts) not selected for the main study. This was to determine the suitability of the questionnaire and the efficiency of the research assistants. This enabled us determine the number of respondents that can be interviewed by the research team in a day and within the study period. Modifications of questions were appropriately done before the final questionnaire was printed for the main study.

### **3.5 ETHICAL CLEARANCE**

Consent was sought from the GHS Ethical Clearance Committee and the DHMT.

Individual consent was sought from respondents and their care-givers before interviews.

Research assistants were informed and trained on the need to keep the information provided confidential.

Identified cases and their contacts were treated with 1.2mega units of benzathine penicillin injection free of charge.

### **3.6 DATA COLLECTION**

Collection of data was done by the principal investigator assisted by six trained field assistants. Structured questionnaires were administered to collect information from household heads of children under 15years who were observed for signs of the yaws disease and selected as cases by three independent technical experts (Disease Control Officers).

In every community visited, children less than 15 years were assembled for examination. They were each given three cards upon which the technical experts wrote their impressions. The care-giver of any child identified as a yaws case was also located and administered a questionnaire by the trained field assistants upon accepting to participate in the research.

### **3.7 QUALITY CONTROL**

Field staff were trained in data collection. The interviewers checked each data collected to ascertain whether the questionnaire was properly filled in before the interview was completed. The principal investigator made on-the-spot checks on the day of interview.

This was to ensure that the questionnaire was properly filled. Any issue arising or encountered was discussed and resolved with the interviewer.

Yaws cases were selected after being examined by three independent experts of the disease (having worked with yaws between 10 to 15 years). A child was only selected as a case after all three experts agreed. If one disagreed the child was only treated as a contact but not included in the study as a case nor a control. The tendency of selecting a case in the place of controls which could result in misclassification was reduced by ensuring that controls do not have any lesions on their bodies whatsoever.

### **3.8 DATA PROCESSING AND ANALYSIS**

Identification codes were put on all questionnaires before they were given to the research assistants. This enabled easy detection of missing questionnaires. Data collected each day was coded. Epi Info (version 6) was used for data capture and SPSS version 16.0 was used in analysis. Chi-square was used to compare proportions and matched odds ratios to find out association between dependent and independent variables. Multivariate analysis was also done using conditional logistic regression.



## CHAPTER 4

### 4.0 RESULTS

A total of 750 children in 20 communities were examined for yaws by the three experts. For 720 of them experts were unanimous as to whether the children were cases or not. For 30 of the children the experts had dissenting views.

Overall, a total of 240 participants (120 case patients and 120 control subjects) were included in the case-control study. Table 1 shows that the cases and controls were similar with respect to age (50 vs. 50) and father's employment status (88% vs. 78%;  $p=0.169$ ). They however differed with respect to father's literacy ( $p=0.003$ ) and father's income ( $p<0.0001$ ).

Compared to control subjects, cases were significantly more likely to have slept in the same room with four or more other relatives (MOR): 2.2, 95% CI: 1.2-4.1), and to have lived in a mud house (MOR): 3.8, 95% CI 2.1-7.2), (Table 2).

In addition, compared with controls, cases were less likely to have more than two rooms in their house (MOR: 0.42, 95% CI: 0.21-0.94), and to have taken at least one fruit (mangoes, oranges) a day in addition to their regular diets (MOR 0.17, 95% CI: 0.05-0.42), (Table 2).

Again compared with controls, cases were more likely to have low income earning fathers and have less-educated fathers, (Table 2).

Living in a house with more than two rooms was protective of the yaws disease (MOR 0.42 95% CI: 0.21-0.93) while fetching water from dams as opposed to bore holes seems to be positively associated with the disease (MOR 1.29(1.03-2.81)  $p=0.033$ ; (Table 2).

Being in possession of household items such as radio and television sets seems to be protective of yaws disease (MOR 0.18(0.10-0.49).

**TABLE 1**

**BACKGROUND INFORMATION ON CASES AND CONTROLS AGED 3-14 YEARS, YAWS STUDIES, GA WEST DISTRICT OF GHANA 2009**

<b>CHARACTERISTICS</b>	<b>CASE</b> N=120 %	<b>CONTROL</b> N=120 %	<b>P- VALUE</b>
Sex of child(female)	49(40)	72(60)	0.003
Child in school	114(95)	120(100)	0.013
Literate mother	46(38)	66(55)	0.077
Mother with > 3 children	102(85)	97(81)	0.391
Literate father(had some education)	81(68)	101(84)	0.003
Father employed	106(88)	93(78)	0.169
Father earning > 50 cedis	33(28)	85(71)	<0.0001
Father farmer	83(69)	70(58)	0.08

**TABLE 2**

**BIVARIATE ANALYSIS TABLE**

**COMPARISON OF POSSIBLE RISK FACTORS ASSESSED ON YAWS**

<b>FACTORS</b>	<b>CASE %</b>	<b>CONTROL %</b>	<b>MATCHED</b>	<b>P- VALUES</b>
			<b>ODDS RATIO 95% CI</b>	
Personal towel use(personal)	18(15)	59(49)	0.17(0.09-0.32)	<0.0001
Father's education(illiterate)	39(33)	19(16)	2.82(1.40-4.60)	0.006
Father's income(low)	87(73)	35(29)	5.00(2.90-10.6)	<0.0001
Sex of child(female)	49(40)	72(60)	0.48(0.26-0.91)	0.007
Bathing more than once a day	94(78)	110(92)	0.33(0.13-0.83)	0.005
Bathing with soap(always)	87(73)	114(95)	0.18(0.12-0.42)	<0.0001
Living in a mud house	92(77)	58(48)	3.83(2.10-7.23)	<0.0001
Houses with > 2 rooms	42(35)	83(69)	0.42(0.21-0.93)	<0.0001
Persons per room(> 4)	42(35)	24(20)	2.20(1.20-4.15)	0.014
Source of water (bore hole)	58(48)	82(68)	0.83(0.35-0.95)	0.033
Distance from water source(near)	110(92)	117(98)	0.30(0.09-1.21)#	0.092
No. of water sources (≥ 3 )	18(15)	33(28)	0.5(0.25-1.05)#	0.138
Balanced diet (diet with fruits)	9(8)	39(33)	0.17(0.05-0.42)	<0.0001
No of meals per day (≥ 3)	94(78)	103(86)	0.6(0.25-1.35)#	0.268
Household items (radio, TV)	79(66)	112(93)	0.18(0.10-0.48)	<0.0001

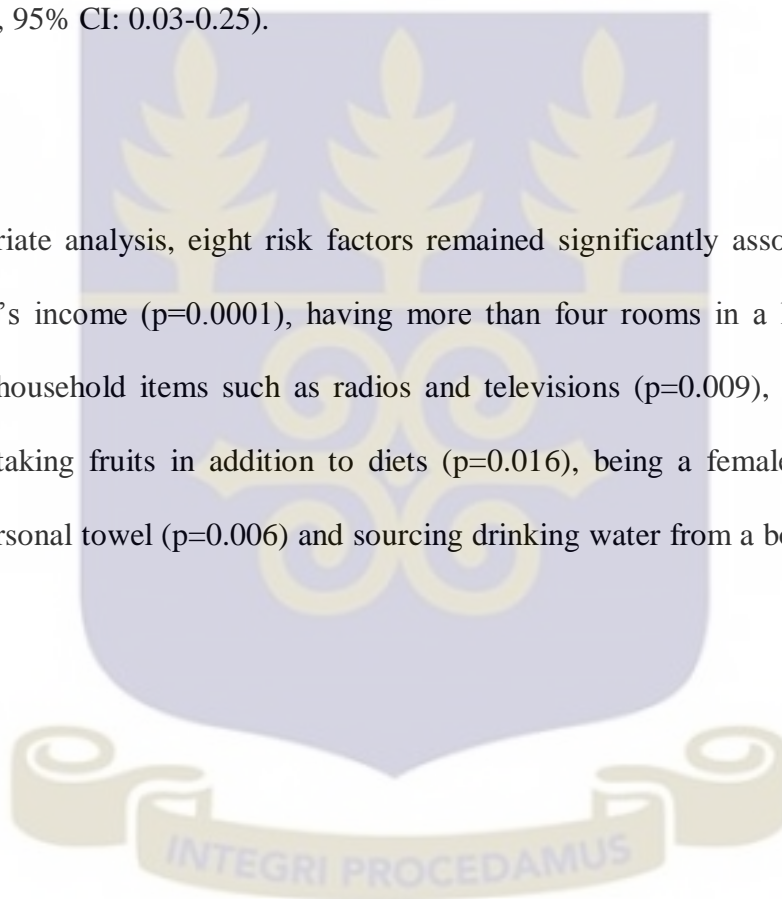
# means not significant

Other exposures, including number of meals taken per day, distance from water source and number of water sources in a community, were not associated with being a case, (Table 2).

Being a female seems to be protective of the disease as well as having a personal towel as opposed to sharing same towel with other relatives (Table 2).

The strength of association between number of baths per day and yaws disease did vary according to sex (adjusted odds ratio (AOR: 0.37, 95% CI: 0.17-0.82), and was confounded by distance from water source (AOR: 0.35, 95% CI 0.16-0.78). Similarly the association between bathing with soap and yaws disease was confounded by father's income status (AOR: 0.08, 95% CI: 0.03-0.25).

On multivariate analysis, eight risk factors remained significantly associated with yaws: High father's income ( $p=0.0001$ ), having more than four rooms in a house ( $p=0.0001$ ), possessing household items such as radios and televisions ( $p=0.009$ ), bathing with soap ( $p=0.005$ ), taking fruits in addition to diets ( $p=0.016$ ), being a female child ( $p=0.028$ ), having a personal towel ( $p=0.006$ ) and sourcing drinking water from a borehole ( $p=0.036$ ), (Table 3).



**TABLE 3**

**CONDITIONAL LOGISTICS REGRESSION TABLE FOR FACTORS  
SIGNIFICANTLY ASSOCIATED WITH YAWS IN THE GA WEST DISTRICT.**

Factors	Regression co-efficient.	P- Value	Odds ratio	95% Confidence Interval for Exp(B)	
				Lower Bound	Upper Bound
Intercept	-2.155	0.061			
Father's education(illiterate) #	0.374	0.428	1.454	0.676	3.668
High (literate)	0	.	.	.	
Father's income(≤50cedis) more than 50 Ghana cedis monthly	1.523	0.0001	4.586	2.208	9.527
Sex of child(female) male	-0.823	0.028	0.439	0.211	0.913
Number of baths per day(twice or more) # once daily	-0.518	0.389	0.571	0.183	1.938
Bathing with soap (Always) sometimes	-1.637	0.005	0.194	0.061	0.617
Number of rooms (> 2 rooms) One or two rooms per house	-1.447	0.0001	0.235	0.113	0.489
Number of persons per room(> 4) # less than four persons per room	0.246	0.568	1.279	0.551	2.976
Primary source of water(bore hole) dams	-0.799	0.036	0.45	0.213	0.951
Personal towel use Sharing of towel with relatives	-1.112	0.006	0.329	0.147	0.734
Diet(with a fruit per day) Diet (without fruits)	-1.177	0.016	0.308	0.118	0.804
Household with (radios or TVs) households without these items	-1.519	0.009	0.263	0.011	0.714
Type of house (mud) # Living in a cement house	0.686	0.078	1.99	0.93	4.261

#- Not significant

## CHAPTER FIVE

### 5.0 DISCUSSION

The multivariate model for the study identified seven other major factors associated with the disease apart from the sex factor. These include: High father's income, household items including radio and television sets, having more than four rooms in a house, bathing with soap, sharing of towels with relatives, consumption of fruits in addition to meals and sourcing water from a dam. Living in a mud house did not seem to be significant in the logistics regression model constructed; even though it was very significant on the bivariate analysis.

Several studies and literature have shown that low socio-economic status is a major factor associated with the disease (Scheman et al 1998), (Chambers, 1938).

#### SOCIO-ECONOMIC FACTORS

Low economic status, crowding and behavioral factors relating to water use are known to be key epidemiological determinants of yaws (Scheman et al 1998). We found that yaws cases were more likely to live in mud houses with fewer rooms than controls. This could be explained by a lower socioeconomic status of their fathers. Crowded living conditions increase the risk of yaws. If more than four individuals slept in the same room they were more likely to be infected. This could be due to increased inadvertent contact with an infected person during sleep (Katz et al 1996). This however was not significant in the conditional logistics regression model, (Table 3). The occupational and educational background of the head of household appeared to be a determinant. Any educational

attainment of the father had a protective effect. This is because socio-economic fortunes are likely to be enhanced with increasing educational attainment.

#### HOST CHARACTERISTICS

The protective effect of the female sex (girls) against yaws observed in our study is consistent with findings of Chambers from London. (Chambers, 1938). This could be due to the facts that girls of school age are usually better clothed than boys of the same age and this is possibly a protective factor which would tend to reduce the incidence in the female (Turner et al 1935).

Avitaminosis was identified as a factor associated with the disease (Hill 1953). This is consistent with our finding that fruit consumption (one fruit per day) is protective of yaws. Fruits with their high ascorbic acid contents help boost the body's immune system thus protecting the children from various diseases including yaws.

#### WATER AND HYGIENE

Poor hygienic conditions have long been associated with the risk of yaws.

The frequency of bath was linked to a diminished prevalence of yaws. Bathing at least twice a day had a significant protective effect. However on logistics regression this was not significant. The effect of using soap appeared to be protective and had a strong impact on the disease. Indeed an unclean yaws lesion with discharge will attract an increased number of flies that could infect more children; bathing children and washing their lesions will diminish this phenomenon as will fly control through the improvement of the sanitary environment (Scheman et al 1998). Availability of water and the related quantity of water used for hygiene practices are other parameters that have positive effects on diminishing

yaws disease (West et al 1995). The reduction of the *T. pertenue* reservoir by antibiotic (benzathine penicillin) treatment at the community level could have an immediate effect on active yaws in the short term but our study highlights the need for the sustainable improvements in hygiene and in the environment which are key to controlling this disease. This study however is not enough to impute causality; further studies need to be carried out preferably cohort studies to investigate these seemingly significant factors thoroughly.

### **LIMITATIONS**

These findings are subject to at least three limitations.

First, there is a high tendency for recall bias since variables were measured retrospectively.

Secondly, respondents may have provided misleading responses.

Thirdly, the behaviour of participants could have changed between the time they were healthy and the time they got infected with yaws. For instance if participants who previously had a bath once daily now bathed three times a day because of the yaws sores, they would tend to bias the study toward the null.



## CHAPTER SIX

### 6.0 CONCLUSIONS AND RECOMMENDATIONS

#### 6.1 CONCLUSIONS

Of all the risk factors examined, father's income seems to have the strongest association with the prevalence of yaws. This was followed by the number of rooms in a house.

Bathing with soap, having a personal towel and eating fruits showed beneficial effects.

Socioeconomic factors such as wealth were significantly explanatory. It is likely that good hygiene practices, education, borehole provision to communities and environmental improvement could have a very significant impact on the prevalence of yaws in the Ga West district of Ghana.

#### 6.2 RECOMMENDATIONS

Hygiene education in the communities of the Ga West district should be intensified by the DHMT in collaboration with the schools since this will go a long way to change attitudes of people towards cleanliness and eventually reduce the burden of disease in these communities.

The school feeding programme in the Ga West district should consider including fruits in their servings of meals to school children since this would strengthen their immune system and protect them from diseases including yaws.

The District Assembly should help mechanize farming in the communities to help improve the economic fortunes of the poor farmers while providing bore-holes for communities without good source of drinking water in the District.

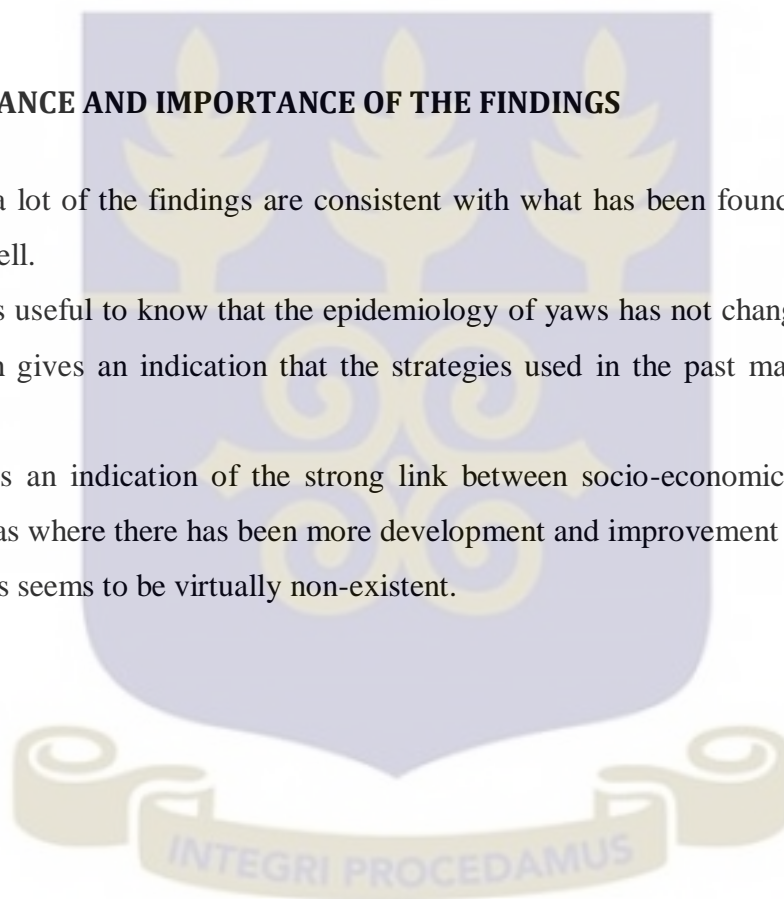
Finally more money should be voted into yaws research in Ghana if the nation is to attain yaws elimination by 2012 according to government policy on the disease.

### **6.3 RELEVANCE AND IMPORTANCE OF THE FINDINGS**

Generally, a lot of the findings are consistent with what has been found elsewhere and in Ghana as well.

It is perhaps useful to know that the epidemiology of yaws has not changed much over the years which gives an indication that the strategies used in the past may still be relevant today.

It also gives an indication of the strong link between socio-economic status and health since in areas where there has been more development and improvement in socio-economic status, Yaws seems to be virtually non-existent.



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## APPENDICES

### APPENDIX 1

#### SAMPLE QUESTIONNAIRES

	Identification .....	Number	Serial .....	Number
	Date:			
Section 1: MOTHER		Name of interviewer		
1.	Name	Q1M NAME		
2.	Age	Q2M AGE		
3.	Education	None Primary Secondary Tertiary Adult literacy	[1] [2] [3] [4] [5]	Q3M EDU
4	Number of children.....			Q4NO.CH
5	Sex of children	M..... F.....		Q5SEX CH
Section 2: FATHER				
6	Name.			

7	Age			
8	Number of wives			
9	Religion	Christian Muslim Traditional None Others	[1] [2] [3] [4] [5]	Q9F REL
10	Level of education?	None Primary JSS/SSS/ Secondary University	[1] [2] [3] [4] [5]	Q10F EDUC
11	Occupation	Unemployed Artisan Trader Professional Civil/ Public Servant Skilled Unskilled	[1] [2] [3] [4] [5] [6] [7]	Q11F OCC
<b>SECTION 3: CHILD</b>				
12	Name of residence			Q12C NAME
13	Age			Q13C AGE
14	Sex	M F	[1] [2]	Q14C SEX
15	Educational background	Pre-school Nursery Primary Junior high No formal education	[1] [2] [3] [4] [5]	Q14C EDUC
16	How many times do you bath in a day	Once Twice Three times		

17	How often do you bath with soap	Always Sometimes		
FACTORS				
18	Type of house	Mud/traditional roof Cement block		Q18 HOUSE
19	Number of room	1 2-3 4-5 6-7		Q19 ROOM
20	Number of people per room	<3 3-5 >5		Q20NO. ROM
21	Primary household water source	Pipe borne Bore hole Hand dug well(covered) Handdugwell (uncovered) Dams		Q21 WATER
22	Number of bore holes/hand dug well in the community			Q22 NO. WELLS
23	Distance from source of water	Less than 30min walk More than 30min walk		Q23 DIST
24	Use of same towel by all family members.	YES NO		Q24 TOWEL

## APPENDIX 2

### CHECK LIST FOR CLINICAL MANIFESTATION OF YAWS

1. A papilloma on the face or extremities, usually the leg that has persisted for several weeks or months and which are painless unless secondarily infected
2. A frambesial(raspberry) lesion which may or not have undergone ulceration (ulceropapiloma)
3. Papillomata occurring in successive crops accompanied by periostitis of the long bones (saber shin) and fingers (polydactylitis)
4. Painful papillomata and hyperkeratosis of the palm and toes
5. Lymphadenopathy

**APPENDIX 3**

DEMOGRAPHIC DATA

POPULATION DISTRIBUTION BY AGE GROUP AND SUB DISTRICT

TABLE 4

TARGET POPULATION	POPULATION FIGURES BY SUB-DISTRICT				DISTRICT
	%	AMASAMAN	POKUASE	OFANKOR/TROBU	TOTAL
		24%	20%	56%	100%
0-11mths	4.00	1,761	1,467	4,109	7,337
12-24mths	2.21	973	811	2,270	4,054
24-59mths	6.63	2,919	2,432	6,811	12,162
5-14yrs	22.08	9,725	8,104	22,692	40,521
15-49 (WIFA)	28.50	12,283	10,236	28,660	51,179
15-49 (Men)	27.00	11,887	9,905	27,735	49,528
50-60yrs(Men & Women)	4.58	2,276	1,897	5,311	9,484

60+ (Men & Women)	5.00	2,201	1,834	5,136	9,172
Total Population	100.00	44,025	36,687	102,724	183,436

**Health institutions in the district are:**

Government Hospitals	-	1
Private Hospitals/Clinics	-	13
Government Polyclinics	-	0
Private Maternity Homes	-	9
Health Centers	-	0
Community Clinics	-	4
CHPS Zones	-	3
<b>Total:</b>		<b>30</b>

**THE TOP FIVE (5) CAUSES OF MORBIDITY IN THE DISTRICT**

**TABLE 5**

<b>Diseases Seen</b>	<b>No.</b>	<b>%</b>
Malaria	1612	72
Skin Diseases and Ulcers	224	10
Diarrhoeal Diseases	168	07

Acute Respiratory Infection	129	06
Home/Occupational Accident	113	05

**TOP TEN CASES SEEN AT OPD IN 2008**

**TABLE 6**

<b>S/N</b>	<b>DISEASES</b>	<b>NO. OF CASES</b>	<b>%</b>
1.	Malaria	19930	30.0
2.	Skin Diseases	8791	13.2
3.	Diarrhea diseases	5807	8.7
4.	Hypertension	2776	4.2
5.	Gynaecological Conditions	2745	4.1
6.	Anaemia	2725	4.1
7.	Other ARI	2490	3.7
8.	Road traffic accident	1648	2.5

9.	Rheumatic/Joint	1575	2.4
10.	Pneumonia	1357	2.0
	All other diseases	16581	25.0
<b>TOTAL</b>		<b>66425</b>	<b>100</b>

**THE HUMAN RESOURCE IN THE DISTRICT**

**TABLE 7**

<b>PROFESSIONALS</b>	<b>NUMBER</b>
MEDICAL OFFICERS	5
MEDICAL ASSISTANTS	5
PUBLIC HEALTH SPECIALIST	1
PHARMACIST	2
DISPENSING TECHNICIANS	5
PUBLIC HEALTH NURSE	1
DISEASE CONTROL	3
ENROLLED NURSES	17

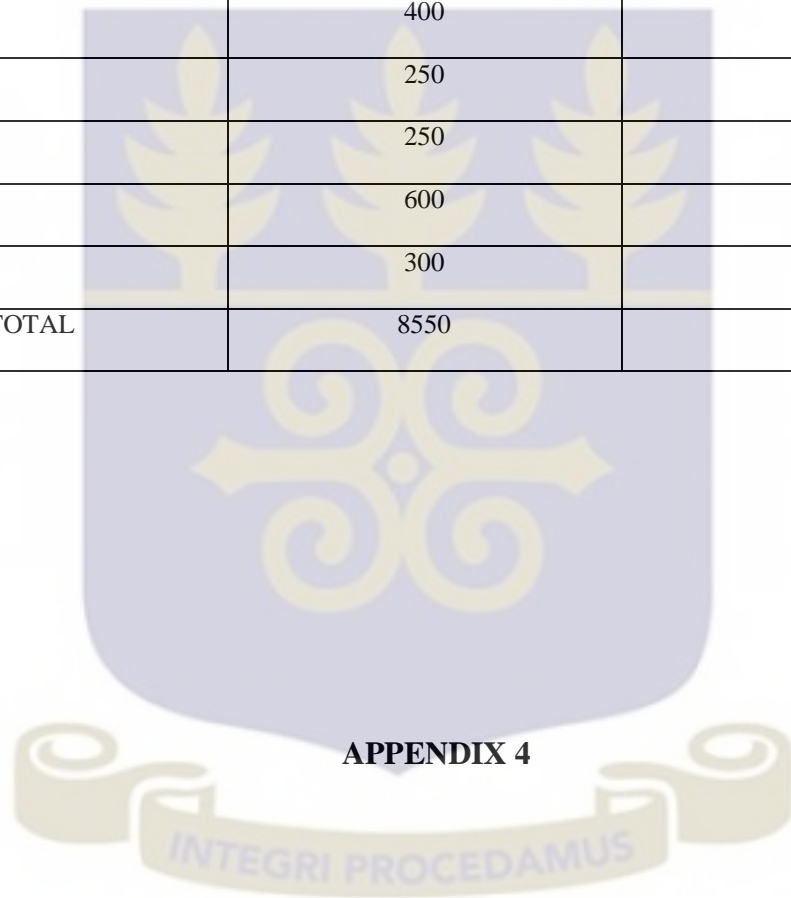
MIDWIVES	30
SR NURSES	32
COMMUNITY HEALTH NURSES	29
HEALTH SERVICE ADMINISTRATOR	1
ACCOUNT OFFICERS	4
HEALTH EXTENSION WORKERS	44
ORDERLIES	11

**TABLE 8**

**DISTRIBUTION OF YAWS BY COMMUNITIES IN THE DISTRICT**

LIST OF COMMUNITIES	TOTAL POPULATION	NUMBER OF YAWS CASES
Kofi Kwei	700	2
Kudeha	250	10
Tomefa	600	2
Paanor	400	8
Twerebo	600	2
Kyekyewere	300	10
Akweiman	450	3
Ayitey Korkor	250	8

Kweku Panfo	400	5
Oduman Asuaba	600	1
Honise	350	10
Amuman	250	10
Domiabra	650	1
Kofi Donkor	550	2
Avonyokope	400	5
Balagonor	400	5
Fankyenekor	250	10
Amuzukope	250	12
Danchira	600	2
Alavanyo	300	12
<b>TOTAL</b>	<b>8550</b>	<b>120</b>



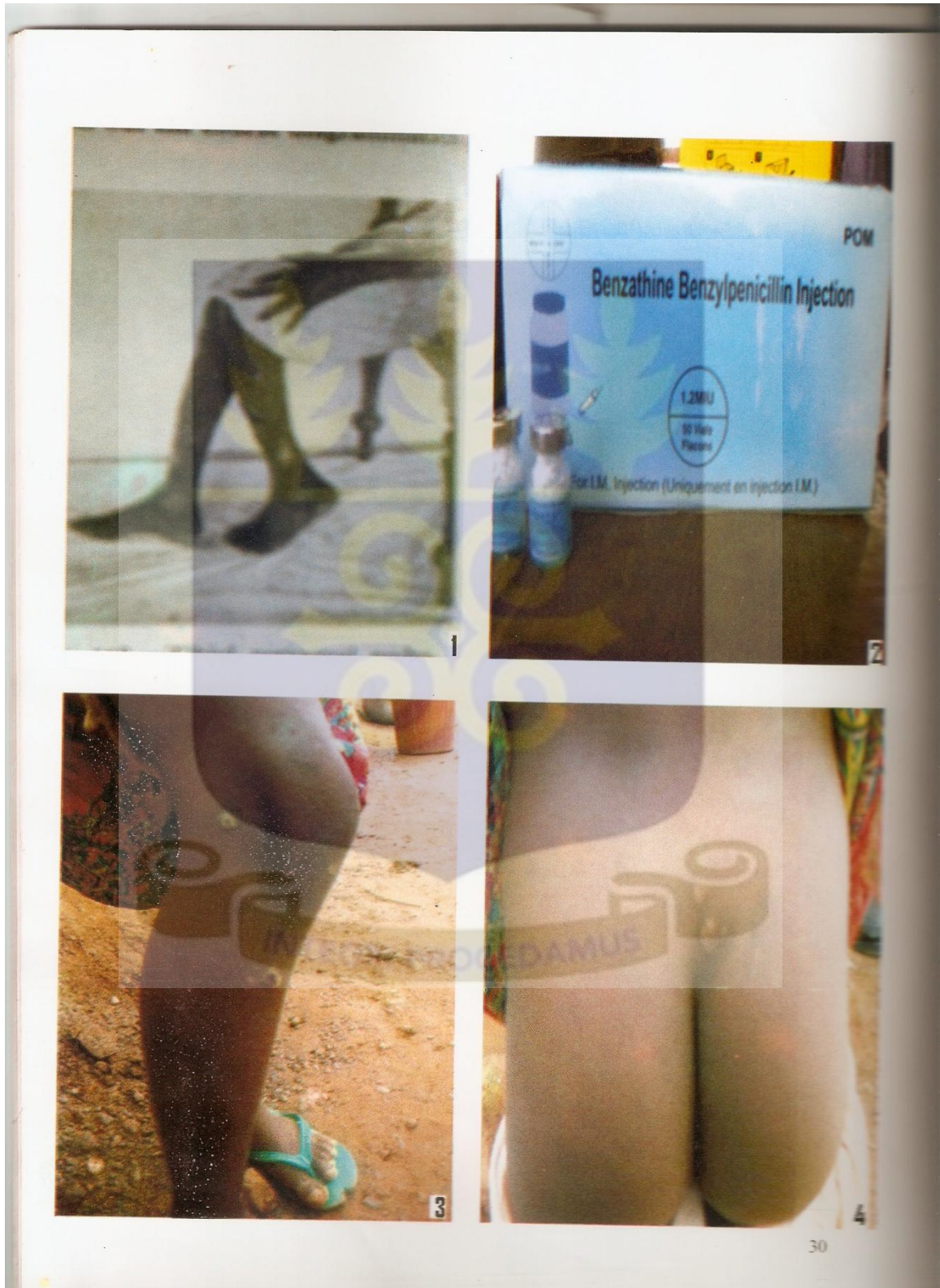
**APPENDIX 4**

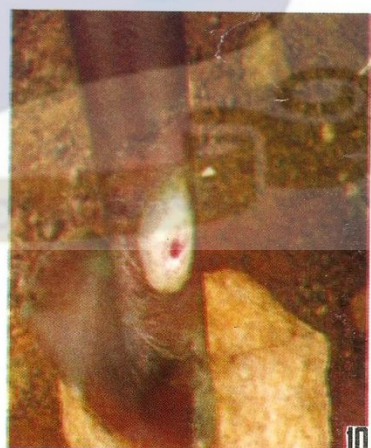
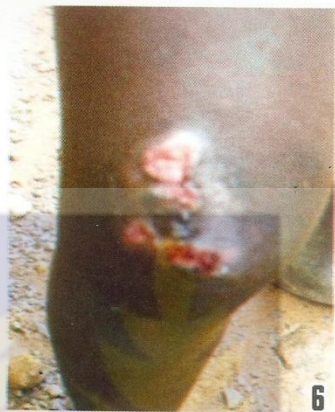
**YAWS PICTURES**

**YAWS PICTURE LABELS**

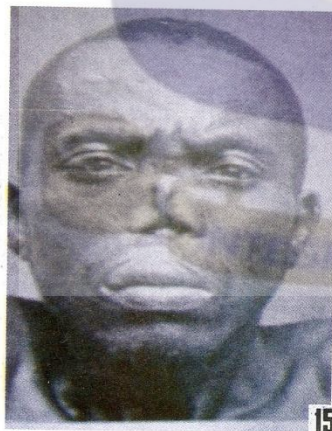
1. Infectious and Non infectious Yaws (Sabre tibia)
2. Benzathine penicillin vials
3. Infectious Yaws (Papilomata)
4. Infectious Yaws (Papilomata)
5. Infectious Yaws (Papilomata)
6. Infectious Yaws (Ulcerated Papilomata)
7. Infectious Yaws (Ulcerated Papilomata)
8. Infectious Yaws (Ulcerated Papilomata)
9. Infectious Yaws (Ulcerated Papilomata)
10. Other ulcer
11. Other ulcer
12. Infectious Papilomata before and after treatment
13. Long bone destruction by yaws (occurs in infectious and non-infectious stages)
14. Non infectious Yaws (Deformed fingers of late yaws)
15. Non infectious Yaws (Gangosa)
16. Non infectious Yaws (Destructive ulcers of late yaws)
17. Infectious Yaws (Ulcerated Papilomata)
18. Infectious Yaws (Ulcerated Papilomata)
19. Infectious Yaws (Ulcerated Papilomata)
20. Infectious Yaws (Ulcerated Papilomata)
21. Infectious Yaws (Ulcerated Papilomata)
22. Other ulcer (Cancer of penis)
23. Diffuse dermatitis (can present in infectious yaws stage)
24. Other ulcer (may be healing ulcerated papilomata)
25. Macular scaly patch (infectious yaws)
26. Macular patch (Infectious yaws)

27. Macular patch (Infectious yaws)
28. Infectious Yaws (Papilomata)
29. Other ulcer
30. Macular patch (Infectious yaws)
31. Other ulcer
32. Macular patch (Macular yaws)
33. Infectious Yaws (Papilomata)
34. Macule (Infectious yaws)
35. Infectious Yaws (Ulcerated Papilomata)
36. Infectious Yaws ( Papilomata)
37. Infectious Yaws (Ulcerated Papilomata)
38. Diffuse dermatitis (can present in infectious yaws stage)
39. Infectious Yaws (Palmar erosion)
40. Infectious Yaws (Healing papilomata)
41. Infectious Yaws (Healed and healing papilomata)
42. Infectious Yaws (Papilomata)
43. Infectious Yaws (Papilomata)
44. Infectious Yaws (Papilomata)
45. Plantar Yaws (Non infectious)
46. Palmar Yaws (Infectious)
47. Tropical ulcer
48. Extensive gangosa (Non infectious)
49. Gondou (Non infectious)

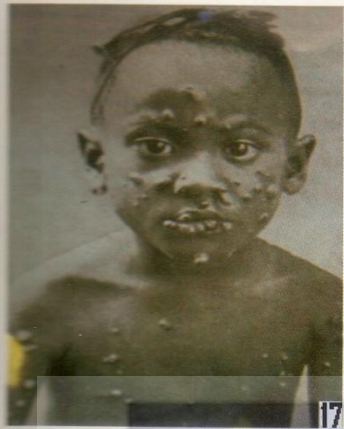




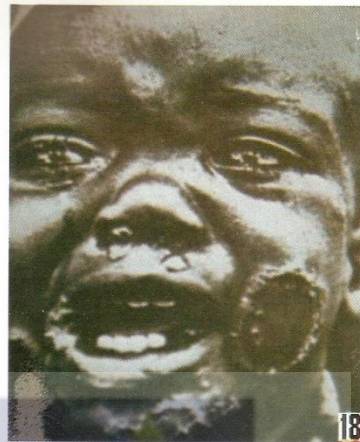
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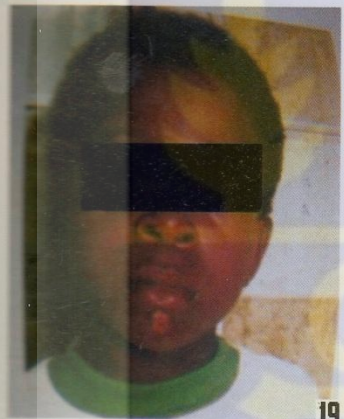
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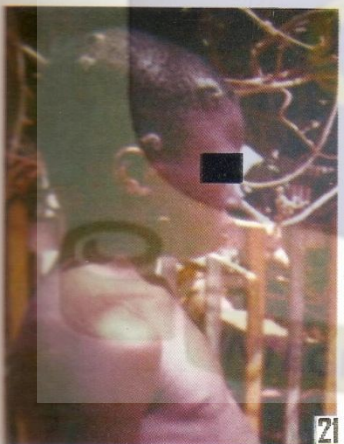
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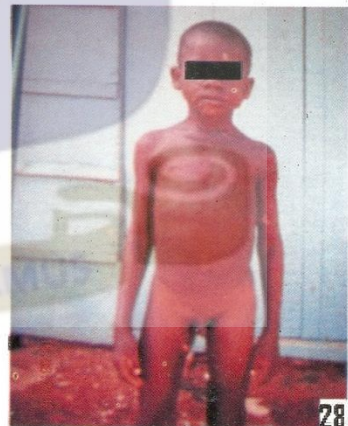
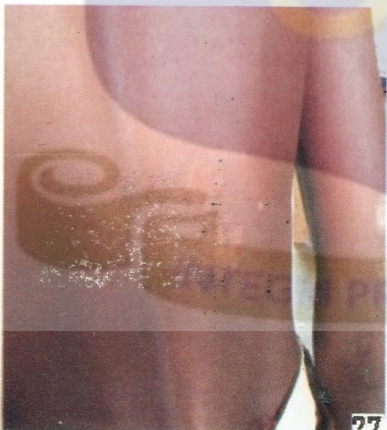
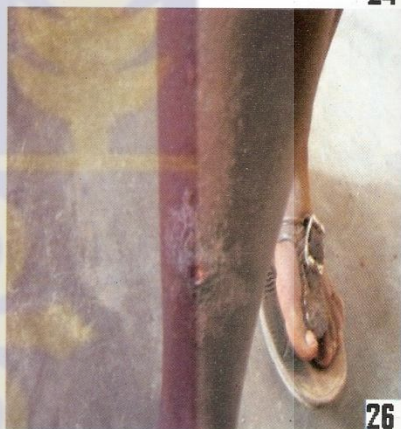
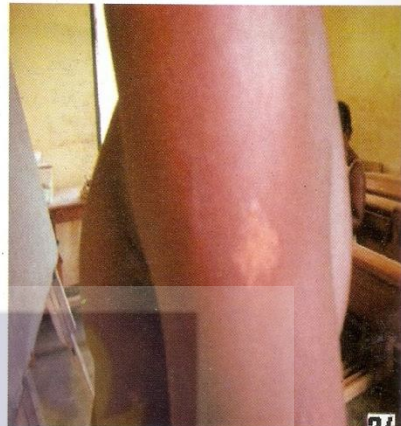


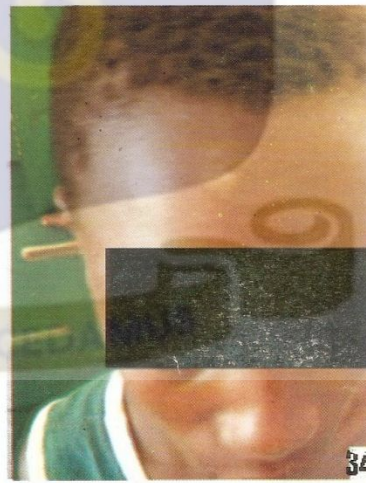
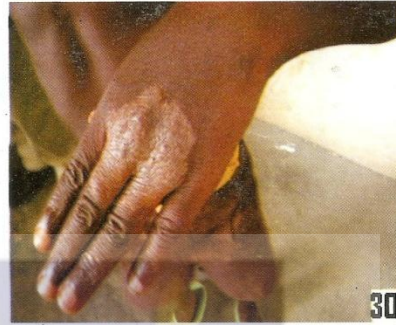
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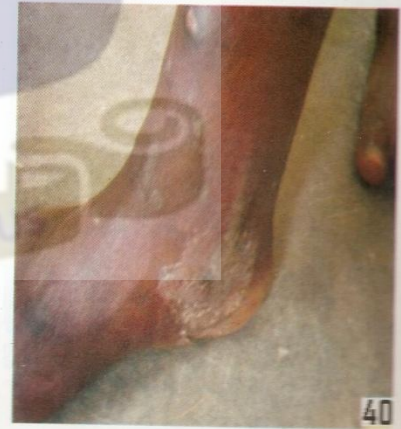
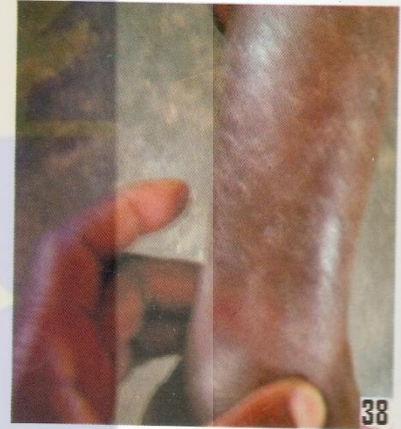
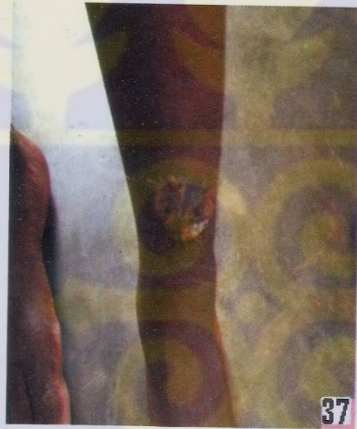
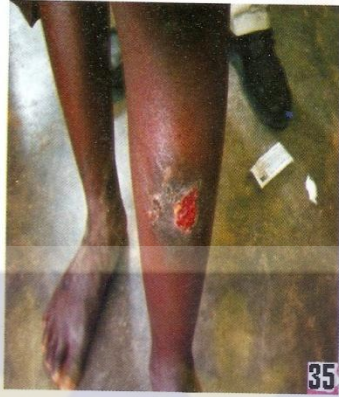
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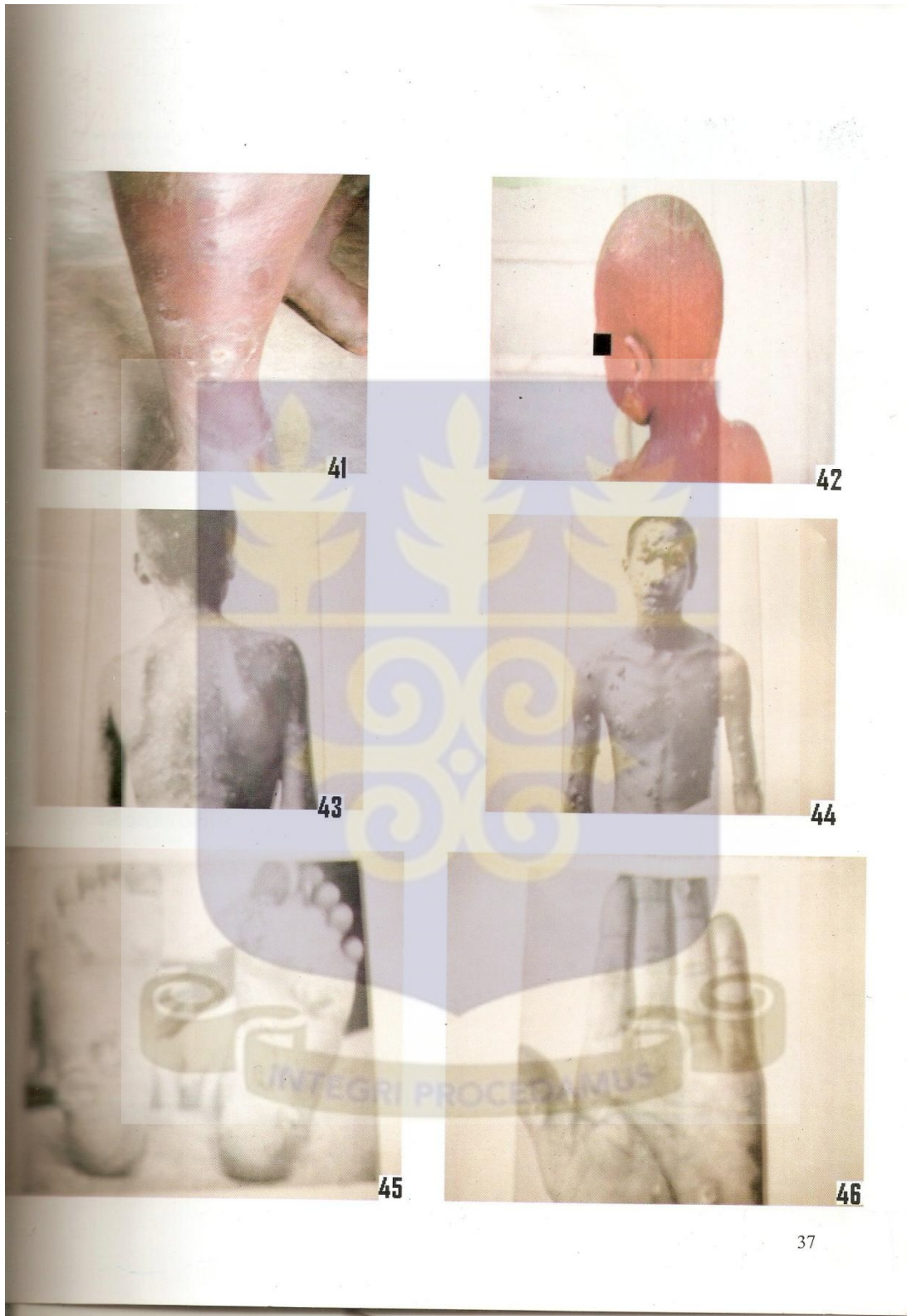
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**APPENDIX 5**

CONSENT FORM

I am ..... And a student of the  
**School of Public Health**, university of Ghana, Legon

I will be pleased if you could grant me permission to ask you these few questions

This study is being carried out to generate information on the risk factors for yaws in this area. The information will be useful in designing education and treatment components for yaws control program.

Your identity and any information that you will give will not be revealed, but be kept confidential and used as explained above

Your participation will be appreciated; however you are reserved the rights to withdraw at any point or time you wish.

DATE.....

SIGNATURE.....OR

