

## AN ABSTRACT OF THE DISSERTATION OF

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Abstract approved:

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Two epidemiological studies, designed to expand our knowledge of morbidity and mortality indicators concerning malaria and Bacillus Calmette-Guerin vaccination in the Hospital Albert Schweitzer health district located in Central Haiti's Artibonite Valley, are presented. The hospital serves a rural population of 190,000 in its 610 square mile district. A large proportion of the rural population still relies on traditional healers in times of illness. Consequently, accurate morbidity and mortality data from individuals and communities in the district are scarce.

The first study investigated an outbreak of axillary lymphadenitis and abscesses after Bacillus Calmette-Guerin vaccination among rural Haitian children treated at Hospital Albert Schweitzer from January 1986 through March 1991. Seventy-seven cases of vaccine-related complications were identified, all among children immunized before the age of 1 year. The proportions of children with complications were 0.017% for 1986 through 1989, 0.91% for 1990, and 2.2% for January through March 1991. The probable explanation for the increase is a change in the BCG strain or in the reactogenicity of the Pasteur strain.

The second study, also conducted at Haiti's Hospital Albert Schweitzer, sought to assess the numbers of malaria cases seen at the hospital in 1982-1991, the distribution of cases by age and sex in the 1989-1991 period, and the validity of official reports indicating an overall decline in malaria cases.

Review of the hospital's laboratory records (1982-1986, 1988-1991), patient medical records (1989-1991), and patient discharge summary cards (1989-1991) revealed 5,251 malaria cases identified through examination of approximately 65,000 blood smears. The largest numbers of cases were diagnosed in 1982 (1,150 cases) and 1988 (980 cases), the smallest numbers in 1990 (120) and 1991 (317). Peak malaria incidence occurred yearly in the November through January period, a few months after the rainy season.

Of the 838 malaria cases found in the 1989-1991 period, 53% occurred in females and 47% in males. Relatively high numbers of cases (41.1 cases per year of age) were found among children aged, 0-6 years, with the largest number of cases in any one-year age group (54) occurring among children 1 year old. (In general, the numbers of cases declined with increasing age.) Eight cases among hospital inpatients ended in malaria-related death; five of these deaths occurred among children aged 0-6 years, and six involved cerebral malaria (a common complication of *P. falciparum* infection).

Overall, the results of this study supported official reports showing a general decline in the number of malaria cases in this region of Haiti between 1982 and 1991. Primary health care may have contributed to the decline in malaria in addition to a 1990 drought in the Dominican Republic, whose mountains supply the district's Artibonite River with its water.

Finally, a brief overview of Haiti's history and its political economy is given because, ultimately, health care is closely related to development and resource distribution.

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## Two Epidemiological Studies in Central Haiti

### CHAPTER I INTRODUCTION

Quantifying health data in lesser developed countries is problematic. Lack of current reliable population statistics, and of morbidity and mortality data of individuals and communities are some of the reasons. Despite such limitations, epidemiological investigations are instrumental in the planning, projection and implementation of health programs as well as in creating global awareness of existing problems and/or trends. In this thesis, two epidemiological studies are presented designed to expand our knowledge of morbidity and mortality indicators concerning malaria and Bacillus Calmette-Guerin vaccination in Central Haiti.

Both investigations were conducted at Hospital Albert Schweitzer in Central Haiti. The first study: "Complications of Bacillus Calmette-Guerin (BCG) Vaccinations in Rural Haiti" assessed the risk of complications (lymphadenitis and/or abscesses) related to the vaccine among rural Haitian children and evaluated whether this risk had increased between January 1986 and March 1991, as theorized by local clinicians.

The second study: "Malaria in Central Haiti: A Hospital-Based Retrospective Study, 1982-1986 and 1988-1991" had two primary goals: 1. To assess whether official reports of an overall decline in the prevalence of malaria could be confirmed by looking at the records of slide-confirmed cases registered between 1982 and 1991 at Hospital Albert Schweitzer, a tertiary referral hospital in the rural Artibonite Valley of Central Haiti. And 2. To assess the secular trend and cyclic occurrence of malaria cases over this time period, thereby providing an independent appraisal of official reports of a

decline in malaria cases. In addition, the study examines the distribution of malaria cases by age and sex and determines the proportion of malaria cases requiring hospital admission, the length of hospital stay, and rate of in-hospital malaria deaths for the period of 1989-1991.

The introduction presents background information on Hospital Albert Schweitzer, Deschapelles. In addition, Haiti's pluralistic health care system as well as common health information and indicators such as infant mortality rate, life expectancy and fertility rate is discussed. Unpublished data (1991) is presented from a house to house survey of 112 rural women of child-bearing age in Borel (population 1490, 4 miles from Hospital Albert Schweitzer) concerning pregnancy-related practices, preferences, and contraceptive use. The focus of the survey is maternal health care, one of the more neglected issues in developing countries. Finally, a brief overview of Haiti's history and its political economy is given because, ultimately, health care is closely related to development and resource distribution.

### HOSPITAL ALBERT SCHWEITZER

In Central Haiti's Artibonite Valley (see Figure I 1.), the 140-bed Hospital Albert Schweitzer (HAS) was founded by Dr. Larrimer Mellon and his wife Gwen Grant Mellon in 1956. The private, non-profit institution operates with a full-time staff of 14 physicians of various specialties. The hospital serves a rural population of 190,000 in its 610 square mile district. Six strategically placed primary health care clinics in its district provide additional care. During 1993, 68,927 patients were treated in the hospital



**Figure I 1.** A map of Haiti showing the location of Hospital Albert Schweitzer, its district and the Artibonite Valley.

clinics: 4,488 required admission (average length of stay of 7.5 days), 17,977 patients were kept overnight and 76,845 received treatment in the rural primary health care clinics (Hospital Albert Schweitzer, 1993).

Besides the practice of curative medicine in the hospital and its clinics, a well-developed Community Health Department stresses preventive health measures, such as screening and monitoring children's growth and nutritional status, immunization, training of traditional midwives to integrate traditional and modern practices, community health education, drilling wells, building latrines and improving farming techniques and animal husbandry.

The population served by H.A.S. depends on agriculture for its livelihood. Most of the district's countryside has scattered, extended family settlements with an occasional village. The majority of houses are made of small wooden frames, mud and thatched roofs or corrugated-ironsheets. Few houses have electricity. Local buses provide daily transportation to the hospital for those who live near the poorly kept roads. Other means of travel are by foot, donkey or on horseback due to a lack of roads in the broad river valley and its mountain ranges.

### HEALTH CARE IN HAITI

Haiti's health care budget is limited and the majority of health services available are provided by missionary groups and non-profit and relief organizations. Rural health care is delivered from widely scattered dispensaries and health clinics and for the majority of the rural population, accessibility is restricted by distance, lengthy waiting times for treatment and lack of monetary resources (Coreil, 1983b).

Thus, it is not surprising that indigenous healers continue to provide a substantial proportion of care in rural Haiti. Local herbalists, traditional midwives, shamans, and injectionists treat many illnesses either by natural and or supernatural means depending on the type and state of illness (Coreil, 1983a; Hess, 1984; Weise, 1976). A survey in southern Haiti revealed that approximately 32% of rural people sought health care from traditional healers and the remaining 68% from the medical profession. Consultations were obtained most frequently from herbalists and in dispensaries together comprising 80% of all consultations. Hospital and shaman consultation were 6% and 5% respectively (Coreil, 1983b).

Rural health beliefs rest on the humoral medicine concept of "hot and cold" and its equilibrium. Imbalance of "hot and cold" factors may relate to food, places, time of days, diseases and/or life state. Diseases with symptoms such as cough, respiratory congestion, and chills are categorized as "cold", and fever, sweating and edema are classified as "hot" (Coreil, 1983a; Hess, 1984; Wiese, 1976). Traditional treatments attempt to restore the body's imbalance using various foods, herbs, teas, compresses, baths and supernatural means. Treatments by natural means are usually reserved for illnesses caused by God; however, illnesses due to sorcery require the shaman to interfere by supernatural means (Brown, 1989). Adrien, Cayemittes & Bergevin (1993) report, for example, that some Haitians believe the only effective treatment for AIDS, called "mo SIDA", is supernatural. Haitians differentiate between two types of AIDS: "mo SIDA" caused by fate and the "medical SIDA" which may be prevented by safe personal behavior.

Coreil (1983b) and Hess (1984) provide useful rural health models based on research conducted in Haiti. Coreil's model focuses on the parallel structures of

professional and folk medicine and their complementary components. She found a mutual respect among both systems; traditional healers referred patients with serious medical problems to hospitals and clinics.

Hess's (1984) holistic model identifies domestic medicine as the center of health care which draws on pooled wisdom of families and its community to treat 80 to 90 percent of all illness. Domestic medicine overlaps with external systems of official medicine, Creole medicine and mercantile medicine. Her extensive research led to the conclusion that additional curative medicine is not the answer to Haiti's rural health problems. Instead, she posits that the solution lies with adequate food and water combined with self empowerment through knowledge and control (pp. 331-341).

It is well-documented in the literature that the lack of adequate nutrition, water, education and primary health care contribute significantly to increased mortality and morbidity from preventable infectious diseases. Accordingly to a World Bank (1993), if child mortality rates of developing countries could be reduced to that of the industrialized countries, 11 million fewer children would die each year. Half of these deaths are caused by diarrhea and respiratory diseases. The number of preventable diseases resulting in death in adults is estimated to be 7 million annually (World Bank, 1993).

Haiti's disease patterns and health indicators such as infant mortality rate (120/1000) and life expectancy (at birth, 55 years for males and 56 years for females) are similar to those of other developing countries (Green, 1992). Although the following health statistics in Table I are over 20 years old, little has changed in rural Haiti, with the exception of AIDS, which has become a major health problem (U.S. Department of Health, Education, and Welfare, Public Health Services, Office of International Health, 1975). (It should be noted that morbidity and mortality statistics are extremely underreported in Haiti and provide only a limited picture of the actual health problems.)

In 1992, 1993 and 1994, the influx of Hospital Albert Schweitzer patient's with nutritionally related diseases rose dramatically due to the imposed international economic embargo. Anthropometric measurements identified 24% of all children ages one to five suffering from either second or third degree of malnutrition. Additionally, the prevalence of measles increased dramatically during 1992 and 1993 despite a sustained measles immunization program. The epidemic subsided in 1994 as a result of a massive measles immunization program at Schweitzer, targeting 53,000 children in 1993 (Hospital Albert Schweitzer, 1993).

Haiti's infant mortality rate (120/1000, Green, 1992), shows a considerable decline from the 1960's when it was listed as 180-190/1,000 (U.S. Department of Health, Education, and Welfare, Public Health Services, Office of International Health, 1975). Factors contributing to the decreased mortality rate include immunization programs, under five clinics, and oral rehydration programs. In the early 1980's, a national campaign to promote the use of oral rehydration was carried out educating mothers, caregivers, and traditional healers on the management of the therapy (Rohde, 1984; Allman, Lerebours & Rohde, 1985; Coreil, 1988). Neonatal tetanus, one of the most prevalent admission diagnoses for infants at Hospital Albert Schweitzer, declined by 86% after a five-year mass immunization program in the district (Berggren, 1974). Now, an estimated 47% of all Haiti children are fully immunized and Hospital Albert Schweitzer reports an estimated 85% immunization coverage in its district (written communication from Hospital Albert Schweitzer, March, 1994).

Tuberculosis has long been a major public health problem for adults in Haiti (90/100,000, as cited in Long, Scalcini, Manfreda, Carre, Philippe & Hershfield, 1991). Recently the incidence of other pulmonary diseases is increasing, perhaps attributable to

TABLE I 1. Most prevalent communicable diseases for adults and children (U.S. Department of Health, Education, and Welfare, Public Health Services, Office of International Health, 1975).

Disease	#/ Thousand P.Y.	#/Thousand P.Y.
1. Intestinal helminthiasis	221.95	7. Whooping Cough 16.00
2. Malaria	219.00	8. Amoebiasis 15.40
3. Syphilis	47.46	9. Tetanus 13.68
4. Gonorrhea	46.22	10. Typhoid 9.06
5. Tuberculosis	40.39	11. Infectious Hepat. 4.25
6. Measles	24.42	12. Chickenpox. 3.36

Most prevalent pediatric admission diagnoses (Hospital Albert Schweitzer, 1991, 1992, 1993).

	1991	1992	1993
Kwashiorkor	573	655	759
Measles	349	440	547
Marasmus	179	279	260
Newborn sepsis	53	108	117
Pneumonia	108	104	79
Tuberculosis	-	-	78
Meningitis	45	65	67
Typhoid	37	153	20

Most prevalent adult admission diagnoses (Hospital Albert Schweitzer, 1992, 1993):

	1992	1993
Tuberculosis	167	132
Typhoid	86	104
Pneumonia	80	59
Pre-eclampsia/Eclampsia	69	53
HIV	47	44
Cerebral Vascular Accidents	42	39
Congestive Heart Failure	64	13



the rising prevalence of AIDS. Pape & Johnson (1988) report a 3% and 10% HIV-1 seropositivity for rural and for urban adults, respectively. In March 1990, Haiti reported 2,331 cases of AIDS, thus ranking it as one of the world's twenty most affected nations (Farmer, 1992, p. 121).

### MATERNAL HEALTH

Morbidity and mortality rates are particularly high for women of child-bearing age in developing countries. Starrs (1987) reports that 20% to 45% of all deaths among women age 15-49 years are from pregnancy-related causes as compared to less than 1% in the United States and most of Europe. Maternal mortality ratios of 500-800 per 100,000 births are common in developing nations, compared to less than 30 in industrialized nations (Royston & Lopez, 1987). Furthermore, the incidence of pregnancy-related complications such as pre-eclampsia, eclampsia, obstructed labor, ruptured uterus, hemorrhage (pre- and postpartum), anemia, ectopic pregnancies, abortion and sepsis may be as high as 30% (Royston & Armstrong, 1989, p. 75).

Theodore's (1992) maternal mortality data from Haiti reported 345 deaths per 100,000 births between 1987-1989, slightly down from the government's projected rate of 367 per 100,000 in 1974-1978 (Khan et al., as cited in Royston & Armstrong, 1989, p. 34). The principal causes for maternal deaths in Theodore's study were: hemorrhage (37%); eclampsia (21.1%); post-partum septicemia (13.9%); abortion (11.9%); intercurrent infections (12.2%); others (3.7%). Hospital statistics at Schweitzer in Haiti (1991) show eclampsia and pre-eclampsia to be the fifth most prevalent medical diagnoses resulting in admission. In 1990, several labor-related maternal/child deaths were reported in a community near the hospital.

Many of the health problems that affect women in their childbearing years have their roots in childhood. Chronic malnutrition and anemia stunts the growth of girls leaving them at high risk for pregnancy-related complications during their childbearing years. A study from Bangladesh, where male children are preferred, reports that boys' caloric intake was 16% more than their sisters up to the age of 5 years, and 11% more between 5-14 years of age. The same study found that 14% of the females were severely malnourished compared to 5% of the males. Severe stunting of growth was observed in 26% of the girls and in 18% of the boys (Chen et al., as cited in Royston & Armstrong, 1989, p. 63). A stronger preference for male rather than female children was observed in Haiti concerning monetary allocation for health care, with mothers spending 50% more on male children than on female children (Coreil, 1983a). This practice may carry over into food distribution as well although a WHO/UNICEF/FHE survey reported no male preference in Haiti (Royston & Armstrong, 1989, p. 51).

Traditional practices and cultural taboos concerning food during and after pregnancy put women at risk of malnutrition and anemia which is compounded by an inadequate supply of adequate food, hard physical labor and closely spaced pregnancies. Wiese (1976) reports that Haitian pregnant and lactating women are classified as "hot". Based on the "hot/cold" concept only 10 of about 74 possible foods are available to rural lactating women promoting nutritional depletion while lactating and for future pregnancies. The author warns that such practices related to this belief are more harmful than poverty itself because it decreases the choices to already limited foods further. In the Middle East and Africa, pregnant women will decrease food intake on the belief that the delivery will be easier because of a smaller fetus. Eggs, fish, fruit, vegetables, meat and milk often are forbidden during pregnancy (Kamel, Mhloyi, as cited in Jacobson, 1992, p. 87).

The literature cites women's age and number of previous pregnancies as the most universally recognized risk factors for maternal mortality and pregnancy-related complications (Royston & Armstrong, 1989, p. 47). Young teen girls' pelvises are not fully developed, thus increasing the risk of obstructed labor and hemorrhage. Moerman (1982) reports that two years after menarche (usually at age 14 years) a girl may have 2% to 9% of pelvic growth. In a Nigeria study, for example, the risk of maternal death in a 15 year old was seven times that of women 20-24 years old for the above cited reason (Harrison, 1985). Early adolescent marriages are, in general, not a problem in Haiti because tradition discourages early sexual union. Allman (1980) reports that young Haitians age 20 to 21 years are considered "children" and/or "youngsters" by their families and are not pressured to enter sexual union. Williams, Murthy and Berggren (1975) found the mean age of sexual union to be 21 years in the Artibonite Valley. (Common law marriages and other visiting unions are the norm in rural Haiti, partly because of high marriage fees and partly because of social acceptance (Allman, 1980).

As women age, an increased risk of pregnancy-related complications has been reported. In a Jamaican study, the risk of death was double for women 30-34 years and increased five-fold for women over 40 years compared to women aged 20-24 years (Walker, 1986). In Haiti, it is common for pregnancies to continue after the age of 35-40 years with the total number of pregnancies as high as 10 and above per women. Pregnancy-related complications may also result in permanent illness or impairments such as vesico-vaginal fistulas, pelvic inflammatory disease, ectopic pregnancy, uterovaginal prolapse and anemia affecting women for the rest of their lives. A village survey in India shows that, for every maternal death, there are 16 pregnancy-related illnesses (Jacobson, 1992, p. 86).

To assess pregnancy-related issues near Hospital Albert Schweitzer, I conducted a survey of 112 young rural women (average 3 deliveries per women, range 1 to 8

deliveries) in the community of Borel. It was found that 19 women experienced: four pre-eclampsias, 11 persistent vomiting, diarrhea, headaches and/or fever and three C-sections. Post-partum complications were reported by 10 women: four retained placentas, one prolapsed uterus, three severe anemias and two with fever and stiffness for a prolonged time. When asked about prenatal care, 91% of the women claimed to have received it "many times," whereas 9% reported none. A review of a random sample of prenatal records in the Borel clinic indicated that 84% of all women sought prenatal care only once or twice. It was assumed that women were aware of the importance of prenatal care and tried to please the interviewer by indicating they had received prenatal care "many times."

One important factor in seeking prenatal care and preventing delivery related complications is the lack of or inadequate availability of health care, poor roads, lack of transportation vehicles, or inability to pay fees and/or fares. According to Mangay-Maglacas (1990, p. 229), nearly half of the births in developing countries are not attended by trained health professionals. In Africa, only 34% of mothers have trained assistants, in South Asia 31% and in Latin America 64% (Royston & Armstrong, 1989, p. 166).

Haiti is no exception. Traditional midwives are instrumental in the prenatal care, delivery and postnatal care of women. Bordes reports that 85% of all babies born in Haiti are delivered by traditional midwives, a figure that is even higher in the remote, rural areas (Bordes, as cited in Coreil, 1983b). In the Borel survey, traditional midwives assisted in 59% of deliveries; family, friends and/or nurses/doctors assisted in 21% and no assistance was available for 20% of women. Reasons given for delivering without help were: alone at home at the time of labor, and sent for midwife but she was not available or did not arrive on time. Although 50% of the women preferred to deliver in the hospital, 40% wanted to stay at home with the option of coming to the hospital if

complications occurred. Ten percent of women expressed no preference. ( In general, hospital deliveries are reserved for complications only. However, Schweitzer is in the process of providing a birthing holding center near the hospital for mothers with potential problems.)

Not only is pre- and postnatal care important to decrease maternal mortality and morbidity but so is the use of contraceptive methods for child-spacing. Gille (1984) reports that contraceptive knowledge and use potentially could decrease maternal mortality by as much as 30%, in addition to the impact it would have on curbing population growth. Yet there are a vast number of people in the world with no knowledge of contraceptive options. A World Fertility Survey in 1983 found that 48% of Haitian women wanted no more children but only 10% of these women were using contraceptives (as cited in Royston & Armstrong, 1989, p. 195). Lack of services as well as inappropriate services are cited as the general reasons for women's failure to use contraceptives (Royston & Armstrong, 1989, p. 197). A family planning organization in Haiti, Profamil, reported that the number of women taking advantage of their services has doubled from this year over last year and services can not meet demands. The organization's mobile clinic performed over 1,000 vasectomies and tubal ligations in 1993 and limited funds restricted additional sterilization procedures (Clancy, 1993-1994).

More recently, Haiti's estimated contraceptive user rate was 10%; and its fertility rate 6% with a population doubling time of 24 years (Green, 1992). Typical of many developing nations, Haiti's population pyramid consists of a very wide base and a narrow peak. Forty-five percent of the population is under the age of 15 years while only 4% is over 65 years (Population Reference Bureau, 1992). The large proportion of the population who are young children is instrumental in the future momentum of population

growth. Even if couples choose a replacement rate of two children the population grows at a rapid rate for some time to come. Historically, development precedes population decline; therefore, Haiti is far from stabilizing its population growth.

Contraceptive knowledge is relatively high in and around Hospital Albert Schweitzer. Community education and development activities by Schweitzer's CHD are the most likely reason. Clinic records from the Borel area revealed that 884 women used various types of contraceptives at one time throughout the year. However, only 33% of this group were actively participating at the end of 12 months. A striking fact was that the majority of participants were in the 37-51 year age range (59%) while 45% of the Haitian population is under the age of 15 years old. This suggests that the value and benefit of contraceptives becomes increasingly important as women age. Reasons for discontinuing contraceptive use was the preference for the injectable (depo provera) to the oral contraceptive and the fact that frequently the injectable medication was unavailable for months.

Exploring family planning-related information from the Borel survey, 112 women revealed that younger women in general wanted fewer children than did their mothers who tended to have an average of six to eight living children. (In rural Haiti, children still are essential to a successful marriage; couples view children as wealth, providing labor and security in old age, Smucker, 1981, p. 3). Results showed that 18% of women wished to bear no more than two children, 28% preferred three children, 23% wanted four children, and 19% wanted five children or more. The remaining 12% of women were undecided about family size. Although many women desired fewer children, 46% were reluctant to use contraceptives, citing side effects such as headaches, nausea breakthrough bleeding as reasons. The remaining 54% of women had tried various methods of contraceptives for short periods but reported that their contraceptive choice was not available and/or that she suffered from side effects.

The role of family planning in developing countries is an important component in preventing maternal morbidity and mortality, empowering women to space births and to choose the number of children she bears. However, the provision of good health services during and after pregnancy as well as educational opportunities for women to achieve empowerment and control are as important as family planning to reduce maternal morbidity and mortality.

### POLITICAL ECONOMY

Haiti is an island of 10,714 square miles in the Caribbean with an estimated population of 6,500,000 (1993) and a population density of 580 per square mile. It occupies the western one-third of the island of Hispaniola with its neighbor, the Dominican Republic, on the eastern side. Its capital is Port-au-Prince with a population of 1.5 million. About two-thirds of Haiti is mountainous and only one-third of its 10,714 square miles can be cultivated. The climate of the island is subtropical. The coastal areas are warm and moist. While some inland areas are in the rainshadows and suffer from moderate to severe drought, other areas receive variable and unpredictable amounts of rain; thus droughts are a frequent problem for the agricultural sector. Several major hurricanes have devastated Southern Haiti during this century.

The official language of Haiti is French. However, 80% to 85% of the population speak Creole only, a language, rich in "tradition, literature, styles, utilities and symbolic values" (Weinstein & Segal, 1984, p. 66). While the official religion is Catholic, the beliefs and practices of voodoo are carried out extensively. According to Murray (1976) "the Supreme life-giving functions have been given to God" and voodoo practices only affect the behavior of the individual and the spirits (p. 77). Voodoo

ceremonies serve as an escape to freedom, "a hallucinatory metaphor for what history had stolen from these people" (Allman, 1989); it gives dignity to a life of hardship and poverty through music, dance, singing and crafts (Metraux, as cited in Weinstein & Segal, 1984, p. 4; Weinstein & Segal, 1984, p. 4).

Why has Haiti, the first independent black republic in the Western Hemisphere, a country with a strong cultural identity and once one of the richest colonies, seen so little economic and social progress over the centuries? Opposing viewpoints have emerged in the literature. Some authors believe that Haiti's underdevelopment is related to the country's small elite who control its political and economic life, leaving peasants politically powerless despite their fundamental importance to the economy (Lundahl 1983; Weinstein & Segal, 1984; Fass, 1988). Underdevelopment also is linked to centuries of colonial and neocolonial economic and political intervention (Caprio, Joachim, as reviewed by Lundahl, 1983, pp. 53-55) as well as to increased population pressure, lack of arable land, primitive agricultural practices and destruction of the subtropical forest (Lundahl, 1983, pp. 42-43). Lundahl further claims that major expenditures over the centuries such as the indemnity to France, a disproportionately large army and police force, and excessive governmental salaries have hampered economic development as well (pp. 32-33).

Historically, Haiti was inhabited by the indigenous Caribs when Columbus Spanish ship first landed on the island in 1492. Within 50 years of arrival of the Spanish, forced labor and exposure to European diseases resulted in near extinction of the native Indians. Labor shortages on the island prompted Spain in 1510 to engage in extensive slave trade from West and Central Africa. However, Haiti's lack of extractable silver and gold decreased Spain's interest in the island and eventually led to its colonization by the French in 1697. Flourishing export of Haiti's sugar cane produced enormous wealth for



France. However, harsh treatment of slaves by French plantation owners, eventually led to a slave rebellion. Napoleon's army unsuccessfully attempted to crush the rebellion and Haiti gained independence from France in 1804.

Political instability for over a century following independence left Haiti the poorest nation in the Western Hemisphere. Internal power struggles (Heinl and Heinl, 1978, report 102 civil wars, revolutions, insurrections, revolts and coups between 1843 and 1915) and external threats to Haiti led to its occupation by the United States from 1915 to 1935. This period resulted in increased foreign economic interests, strengthening of national identity due to white domination and preparation of the country for Duvalier's centralized government (Weinstein & Segal, 1984, p. 21-22; Wilentz, 1989, p. 205). The Duvalier's dictatorship (father and son) and repression contributed to Haiti's persistent poverty (1957-1986) as did the successive military juntas following Duvalier's flight. The exception was Father Aristide, the democratically-elected president whose few months in office were terminated by the military junta in 1991. Aristide (1990) who wrote: "To ask for a plate of rice and beans every day for every man, women and child is to preach revolution," promised a brighter future for the impoverished Haitian, a promise he could not fulfil (p. 8).

The political history of Haiti from 1492 to 1986 predominantly was a struggle within the wealthy political class according to Fass (1988, pp. 31-32). The wealthy class did little over the centuries to improve the lives of Haiti's impoverished population. It taxed agricultural exports and imports, yet exempted itself; it allocated less than 10% of public expenditure to the agricultural sector despite the fact that 80% of the Haitian population is agrarian (Fass, 1988, p. 8; Lundahl, 1983, p. 31). About 83% of public expenditure ended up in Port-au-Prince (Fass, 1988, p. 8), of which 79% was spend for salaries alone (World Bank Report, 1979). This percentage has over the years increased

to 90% to 95% (Klarreich, 1993). Little money remains for social services. Weinstein & Segal (1984) claim that health, education and other services are provided almost solely by charitable organizations and other private donors (p. 50).

This marginalization of the rural population by the political process might, according to Lundahl (1983), result in "the Malthusian prediction where the population is compelled to reduce its numbers in accordance with the country's diminished resources (p. 40)." Fass (1988) sees a solution to such imbalances in the revision of the political economy (pp. 1-8, 117), a political economy which Weinstein & Segal (1984) call "pirate politics on a rudderless ship" (p. 103).

Haiti was the first Latin America country to undergo land reform shortly after its independence when plantation holdings were divided among slaves for cultivation. Traditionally, land entitlement has been passed down to both male and female children. Although land tenants have no written proof of ownership, and theoretically, all land belongs to the government, burial site of ancestors serve as ownership proof. (Weinstein & Segal, 1984, p. 86-87; Smucker, 1981).

Small scale labor intensive peasant farming, commerce and some home industries are means of economic survival for the rural population. Male and female roles tend to complement each other. Men perform the more challenging physical work and are considered the head of the household whereas women ("Madam Sara") dominate the domestic market activities by selling farm products. An extensive network of "Madam Sara" provide the trading link between rural and urban markets often operating with very low profit margins (Lundahl, 1983, p. 27; Weinstein & Segal, 1984, p. 58-59; Smucker, 1981).

Historically the survival of the peasant society in Haiti rested on its egalitarian practice of collective and reciprocal work (Lundahl, 1993). To prevent absorption by the state, peasants operated in parallel and independent of the state, trying to ignore the

state as much as possible (Clastres, as cited in Lundahl, 1993). Strategies to remain autonomous according to Lundahl (1993) "include multiple names, hiding facts like the practice of voodoo and who has power in the community." Yet, slowly, this society is changing as a result of population pressure, shrinking resources, outmigration, and other exterior forces (Barthelemy, as cited by Lundahl, 1993).

Rural Haiti, once rich in vegetation and other biological resources, has suffered severely as a result of overpopulation, soil erosion and poor farming practices. Agricultural production barely meets the subsistence needs of 60% of its labor force. When international coffee prices fell, coffee trees were uprooted for quick growing crops. Ninety-five percent of the subtropical hardwood forest has been cut down, and efforts to expand food production have resulted in severe soil erosion.

Currently, the chief export crops are coffee, sugar and cocoa. Other agricultural crops grown for local consumption include maize, manioc, several kinds of peas and beans, rice and all tropical fruits but especially mangoes (Lundahl, 1983, p. 24). Coconut trees, once plentiful, are rapidly dying on most of the island from a disease (personal observation, 1991) and mangoes are being cut for charcoal/fuel. Reforestation efforts are in progress under the auspices of various Non Government Organizations, but it will require years before their effects may be seen or felt, if at all, since wood is an important source of fuel for the rural population.

Lack of government interest in increasing domestic food production beyond maintaining stability poses a constant problem in Haiti's labor intensive economy (Fass, 1988, p. 123). To maintain stability, the government relies more and more on wheat imports because the domestic agricultural community cannot meet the increased urban food demand (Lundahl, 1983, p. 10). In St. Martin (a suburb of Port-au-Prince), middle-class families with an average income of \$9.80 U.S. per adult per month were able to afford a 1600-1800 caloric diet per adult per day. However, over 60% of St. Martin's

households had income below the average (Fass, 1988, p. 148). Making matters worse, income has not kept pace with rising consumer prices. Between 1970 and 1985, bread prices increased by a factor of 2.5, rice by 3.6 and corn by 7 (Fass, 1988, p. 150-151). The per capita income has fallen from \$431 in 1980 to \$212 in 1992 which may be even lower in 1993 (Clancy, 1993-1994).

Nutritional surveys by the World Bank (1978) and the United States Aid for International Development (USAID) (1978), conducted in the poorest suburb of Port-au-Prince, found that 15% and 14% of children were adequately fed, 21% and 14% showed first degree protein calorie malnutrition, 40% and 47% second degree and 24% and 25% third degree (p. 30; p. 28). Charitable relief organizations such as CARE and the Catholic Relief Services daily are feeding an estimated 750,000 children and adults at risk of malnutrition and starvation in various parts of the country (Robinson & Tarr, 1992, February 17).

Besides nutrition, water, sanitation and education are problematic as well in Haiti. Sixty percent of the population lacks access to safe drinking water, and 79% have no sanitation facilities (Green, 1992). The current literacy rate in rural Haiti is listed as low as 10% (Lundahl, 1983, p. 35). Although education is valued highly in both rural and urban families, a rural/urban imbalance of school facilities and budgets is striking (Vielot, as cited in Lowenthal, 1976). Furthermore, schools are overcrowded, expensive, have poorly trained teachers, require long walking distances and are taught in French instead of Creole, a foreign language to the rural population (Weinstein & Segal, 1984, p. 64). Consequently, only about 2%-3% of rural students finish primary school (Vladman, as cited in Weinstein & Segal, 1984, p. 65; Lundahl, 1983, p. 35).

Out-migration of Haitians to neighboring countries, legal or illegal, has been one of the mechanisms to control population pressure and poverty. Haiti experienced a large out-migration of laborers to Cuba's sugar plantations at the turn of the century. More

recently regular migration to the Dominican Republic occurs where as many as 200,000 Haitians work on sugar plantations under dreadful conditions (as cited in Lundahl, 1983, p. 128-129). Sadly, the Haitian treasury and private contractors have profited handsomely from this legal labor export. Fass (1988) reports that, in 1981, a fee of \$182.00 per legal worker was given to the Duvalier government, amounting to about 3 million dollars per year for the estimated 16,000 workers. Other migration destinations for Haitians include the United States, Canada, France, the Bahamas, Martinique, Guadeloupe, and Venezuela (Allman, as cited in Fass, 1988, p. 47). Such temporary and permanent out-migration also eliminates the need for jobs in Haiti's labor market and provides a substantial remittance to Haitian families (Fass, 1988, p. 48).

Haiti's political and socio-economic struggles continues. The current Haitian military's refusal to reinstate its democratic government has led to two internationally-imposed economic embargos. Both rural and urban populations are struggling to survive the embargo. Smolowe (February 1992) reports food shortages and malnutrition to be the consequences of the embargo as well as increases in diseases well above their usual norms. Furthermore, government-run immunization programs have been halted to conserve fuel, needed for refrigeration. Harvest produce can not be transported to urban markets because of fuel shortage. Currently, gasoline may be bought for \$10.00-\$15.00 per gallon for each plastic jug on the streets of Port-au-Prince and other cities because gas stations are closed (written communication from Hospital Albert Schweitzer, March 1994). Additionally, peasants have accelerated the cutting of mango trees and the remaining mahogany trees that shade coffee crops to make charcoal in place of propane gas and kerosene, thus further damaging the environment (Diederich & McAlister, February 1992).

In Port-au-Prince, some 160 assembly plants have closed due to the embargo causing the loss of 144,000 jobs (Punishing Victims, February 1992; Diederich &

McAlister, February 1992). Economic activity decreased by an estimated 30% to 50% while prices rose approximately 35% (Robinson & Tarr, February 1992). This economic hardship in addition to the human-rights violations stimulated mass exodus attempts of approximately 45,000 boat people in 1991 and 1992. Such exodus attempts have since been forcibly halted by the United States (Huddled Masses, May 1992; Aristide as cited in Clancy, 1993-1994). Furthermore, some \$200-\$300 million in annual contributions from relatives living in the U.S. have ceased to enter Haiti because of the embargo (Punishing Victims, February 1992).

Official import and export industries have ceased to exist. The tourist industry, once profitable, providing million of dollars annually and hundreds of jobs, collapsed due to the accusation that Haiti was the source of AIDS and because of continuing political instability (Farmer, 1990, p. 146; Fass, 1990, p. 45).

What is the solution for Haiti's chronically destitute state? In essence: political will to embrace a less corrupt, democratic government; a government that will restructure its tax system and invest in the social and economic infrastructure to improve education, increase job opportunities, increase primary health care and commit to population control; a government that supports its agricultural society providing training, appropriate technology, loans to implement such technology, promoting reforestation, soil preservation and building roads and telecommunications services. Given just a little opportunity the vibrant Haitian society will transform the island to a sustainable and prosperous economy.

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## CHAPTER II

## COMPLICATIONS OF BCG VACCINATIONS IN RURAL HAITI

by

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### ABSTRACT

This study investigated an outbreak of axillary lymphadenitis and abscesses after Bacillus Calmette-Guerin vaccination among rural Haitian children treated at the hospital Albert Schweitzer from January 1986 through March 1991. Seventy-seven cases of vaccine-related complications were identified, all among children immunized before the age of 1 year. The proportions of children with complications were 0.017% for 1986 through 1989, 0.91% for 1990, and 2.2% for January through March 1991.

## INTRODUCTION

The World Health Organization recommends the use of *Bacillus Calmette-Guerin* (BCG) vaccine in developing countries where the incidence of tuberculosis is high, even though the vaccine's effectiveness is variable (World Health Organization, 1980; Anonymous, 1980; Miller, 1982; Ten Dam & Hitz, 1980).

Lotte, Wasz-Hockert, Poisson, Dumitrescu, Verron & Couvet (1984) point out that there are few data concerning complications related to the vaccine in developing countries; thus, estimating global rates of vaccine-induced complications remains problematic. Outbreaks of BCG vaccination complications such as lymphadenitis and abscesses are uncommon (Miller, 1982) although several outbreaks have been reported from various countries worldwide (Mandell, Douglas & Bennett, 1979; Praveen, Smikle, Prabhakar, Pande, Johnson & Ashley, 1990; Helmick, D'Souza & Goddard, 1986).

The objectives of this study were to assess the risk of complications (lymphadenitis and/or abscesses) related to the vaccine among rural Haitian children and to evaluate whether this risk had increased between January 1986 and March 1991, as theorized by local clinicians.

## METHODS

The study was conducted at the Hospital Albert Schweitzer, located in the Artibonite Valley of rural Haiti. The hospital is the major provider of medical care to a district population of approximately 190,000 persons. The hospital's Community Health Department routinely vaccinates children within its district with BCG shortly after birth (or later if not vaccinated previously). Vaccination is performed by "vaccination teams" whose sole responsibility is the vaccination program. These teams travel throughout the

district to bring the vaccination program to remote, rural populations. Hospital staff had observed an apparent increase in complications related to the vaccine beginning in early 1990.

All in-district children (birth through 5 years of age) who experienced complications related to BCG vaccination and who were treated at the Hospital Albert Schweitzer from January 1986 through March 1991 were identified by review of the hospital's discharge summary cards and patients' medical records. A case of complications related to the vaccine was defined as any child who was immunized within the past 4 months and who presented with right axillary and/or supraclavicular lymphadenitis of at least 2 cm in diameter with or without an abscess.

The approximate proportion of children with BCG-related complications was estimated by relating the number of cases of vaccine-related complications identified within a specific time period to the number of children vaccinated during that time period. This approach was used because the available data did not allow follow-up of specific cohorts of vaccinated children. The number of children vaccinated per quarter remained relatively stable over the study period.

The BCG vaccine lot numbers for 1990 and 1991 were available from the Haitian government physician in charge of distributing vaccines. These lot numbers were Pasteur (Paris, France) R 5523 (for most of 1990) and E 5174 (for most of the first quarter of 1991).

## RESULTS

Seventy-seven cases of BCG-related complications were identified among in-district residents. Table II 1. shows the number and percent of children with BCG-

TABLE II 1. Number and Percentage of Children with Complications Related to the Bacillus Calmette-Guerin Vaccine: Hospital Albert Schweitzer, Haiti.

Age at Vaccination	Age Diagnosed with Vaccine-Related Complications	1986-1989		1990		January-March 1991	
		No of Cases	Compli-cations %	No of Cases	Compli-cation %	No of Cases	Compli-cation %
<hr/>							
Fewer than 12 months		3	0.017	41	0.91	33	2.2
	1-4 months	3	.....	33	.....	23	.....
	5-11 months	0	.....	8	.....	8	.....
	12-14 months	0	.....	0	.....	2	.....
12 months or older		0	0	0	0	0	0

Note: The number of vaccinations performed was available only for two age categories, fewer than 12 months and 12 months or older, although the hospital policy is to vaccinate shortly after birth.

related complications by age at vaccination, age at diagnosis, and time period. The percent of vaccinated children with BCG-related complications increased from 0.017% in 1986, to 0.91% in 1990 and 2.2% in January through March 1991. No BCG-related complications were identified among the approximately 1400 infants immunized at age of 12 months or older.

For 1990, 20 of the identified cases were boys and 21 were girls. Eleven of the 41 cases were diagnosed in the first quarter of 1990; the corresponding numbers for the second, third and fourth quarters of 1990 were 18, 4, and 8. Nineteen infants (46%) presented with abscesses which either drained spontaneously or required surgical drainage.

From January through March 1991, 21 of the 33 identified cases were boys and 12 were girls. Twelve infants (36%) presented with abscesses.

All of the cases of BCG-related complications were diagnosed between eight days and four months after vaccination. Upon examination, large right axillary nodes were found, frequently associated with fever and/or abscesses that required drainage or spontaneously drained (The vaccine was given intradermally over the right deltoid). Only a few of the abscesses were cultured; two were reported positive for *Mycobacterium bovis*. One child was diagnosed with supraclavicular nodes. As a rule, all affected infants received oral isoniazid for three to six months after diagnosis.

The relative proportion of children with BCG-related complications for 1990 as compared with the proportion for 1986 through 1989 was 54; the comparable relative proportion for January through March 1991 was 133.



## DISCUSSION

Improper vaccination technique, route of vaccination, and dosage and storage of the vaccines were unlikely causes of the increased risk of complications (Lotte et al., 1984; Vig-Neilson, Madsen, Allfather, Halkjaer-Lassen, Schultz, Guld, Rasmussen & Helweg-Larsen, 1955; Martinez Barrow, 1971; Carballo & Sanchez, 1972). The hospital follows the manufacturers recommendations concerning vaccine refrigeration during storage and transport. Although the BCG vaccine is distributed by the Haitian government, UNICEF's consultants oversee vaccine storage and distribution. Disposable, single one millimeter syringes were used to prevent dosage errors. All immunization technicians had worked at Hospital Albert Schweitzer for at least two years prior to the start of the outbreak. In addition, the cases did not cluster at any immunization post. On the basis of the hospital records, complications at the vaccination site itself were reported for only one child between January 1990 and March 1991, attesting to the skills of the vaccination technicians. In rural Haiti, axillary and/or supraclavicular lymphadenitis is rare unless associated with vaccination, trauma, or extreme malnutrition (B. Bonnländer, verbal communication, August 1992).

One possible source of error warrants discussion. It is likely that the number of cases of BCG-related complications were under-reported because the long travel distances to the Hospital Albert Schweitzer make it difficult for parents to bring their children to the hospital, particularly if the child's condition is regarded as being non-life-threatening. Differential under-reporting of cases by time period is an unlikely explanation for the observed secular trend in risk, however, because the magnitude of the increased risk observed was large and because identification of cases was determined

primarily by the individual family members' ability to seek care at the hospital and not on any particular awareness of BCG-related complications among the hospital's clinical staff.

The results strongly suggest that there has been a secular increase in the risk of BCG-related complications in Haiti beginning in 1990 that continued through the first quarter of 1991 (the last period of observation). The probable explanation for the increase is a change in the BCG strain or in the reactogenicity of the Pasteur strain. Unfortunately, it was not possible to relate any change in vaccine strain or lot number directly to the increased risk of BCG-related complications because Hospital Albert Schweitzer does not routinely record the lot number of BCG vaccines used.

Praveen et al. (1990) were unable to identify a single cause for the BCG-related complications in Jamaica and attributed them instead to an increased reactogenicity to the Pasteur strain. Vaccine-associated complications in Jamaica stopped after the Pasteur BCG vaccine was discontinued. Helmick et al. (1986) reported the occurrence of BCG-related complications in St. Lucia in 1982 when using a Connaught BCG vaccine; these complications ceased after they changed to a Glaxo BCG vaccine in 1983.

The study results confirmed the findings of De Souza, Sant 'Anna, Lapae Silva, Mano & Bethlem (1983) with respect to the increased risk of BCG-related complications among infants less than five months old compared to older children. In the present study, 75 percent of all complications were found in infants aged one to four months.

Adverse reactions to vaccines may jeopardize public acceptance of immunization programs. Thus, surveillance of vaccine reactions is a key component of these programs. Hospital Albert Schweitzer's experience demonstrates the importance of such surveillance, the identification of increased reactions through surveillance, and the need to change the vaccine strain.

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## CHAPTER III

MALARIA IN CENTRAL HAITI: A HOSPITAL-BASED  
RETROSPECTIVE STUDY, 1982-1986 AND 1988-1991.

by

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### ABSTRACT

A retrospective study conducted at central Haiti's Hospital Albert Schweitzer in June of 1991 and January of 1992, sought to assess the numbers of malaria cases seen at the hospital in 1982-1991, the distribution of cases by age and sex in the 1989-1991 period, and the validity of official reports indicating an overall decline in malaria cases.

Review of the hospital's laboratory records (1982-1986, 1988-1991), patient medical records (1989-1991), and patient discharge summary cards (1989-1991) revealed 5,251 malaria cases identified through examination of approximately 65,000 blood smears. The largest numbers of cases were diagnosed in 1982 (1,150 cases) and 1988 (980 cases), the smallest numbers in 1990 (120) and 1991 (317). Peak cases incidences occurred yearly in the November through January period, a few months after the rainy season.

Of the 838 malaria cases found in the 1989-1991 period, 53% occurred in females and 47% in males. Relatively high numbers of cases (41.1 cases per year of age) were found among children 0-6 years old, with the largest number of cases in any one-year age group (54) occurring among children 1 year old. (In general the numbers of cases declined with increasing age.) Eight cases among hospital inpatients ended in malaria related death, five of these deaths occurring among children 0-6 years old and six involving cerebral malaria (a common complication of *P. falciparum* infection). Overall, the results of this study support official reports showing a general decline in the number of malaria cases in this region of Haiti between 1982 and 1991.

## INTRODUCTION

In recent years, reports around the globe have warned of a worldwide malaria resurgence (Anonymous, 1991). Historically, global attempts to eradicate the disease failed in the 1950's and 1960's, and malaria control therefore came to be recommended as an alternative because eradication was too hard to achieve (Bruce-Chwatt, 1987; Brown, Haworth & Zahar, 1976; Najera, 1989; World Health Organization, 1969; 1978).

This change to a control strategy has not managed to reduce the incidence of the disease in the Americas. Indeed, in 1990 the World Health Organization (WHO) reported that the number of malaria cases detected in the Americas has been rising steadily since 1974--from 269,000 cases in 1974 to 1.1 million in 1988.

Nevertheless, the reported malaria incidence declined in the late 1980s in the Caribbean, where endemic malaria is limited to Island of Hispaniola. Specifically, the number of recorded cases in the Dominican Republic fell from 1,400 in 1986 to 1,100 in 1988 and to 356 in 1990; and the number of officially reported cases in Haiti went from 17,000 in 1985 to 12,000 in 1987 and 1988 (World Health Organization, 1992). Because reported malaria cases frequently led to underestimation of malaria's true prevalence, one aim of the present study in Haiti was to corroborate official reports of malaria's decline.

Garcia-Martin reported in 1972 that about 74% of the Haitian population was living in malarious areas. While no comparable current estimates are available, it is known that a substantial proportion of the country's population still lives in such areas. An aggressive distribution of antimalarial drugs during the years 1964-1968, combined with an irregular but high rate of house spraying (an average of 343.23 houses per thousand inhabitants, with a standard deviation of 133.3) in 1962-1966 reduced the

annual parasite incidence (API) per 1000 inhabitants from 5 in 1964 to 0.6 in 1968. As the vector control operations became more irregular between 1972 to 1984, however, the API rose from the 1968 figure of 0.6 to 12.6 in 1982 (Pan American Health Organization, 1986). The Pan American Health Organization (PAHO) reported a 2.9% annual parasite incidence in Haiti for 1986 but cautioned that these results might not be comparable because of the modified case detection system. WHO reported a 31% to 37% rate of positive blood specimens between 1988 and 1990 (World Health Organization, 1992; Bulletin of the Pan American Health Organization, 1986; 1988; Epidemiological Bulletin, 1988).

The agent of malignant tertian malaria, *Plasmodium falciparum*, causes most of the malaria cases in Haiti. However, Cavalie & Limousin (1966), reported some *P. vivax*, and PAHO has reported *P. malariae* (Bulletin of the Pan American Health Organization, 1986). In addition, two basic facts have major epidemiologic and disease control implications for the island. First, chloroquine resistance has not emerged in *P. falciparum*, and recent clinical experience at Hospital Albert Schweitzer has indicated that this was still the case in 1993. Second, at one point it was found that there was little DDT resistance among vector mosquitoes on the island (Garcia-Martin, 1972), an observation that remains to be updated.

The study reported here, which was conducted in June of 1991 and January of 1992, had two primary goals. The first was to see whether official reports of an overall decline in malaria's prevalence could be confirmed by looking at the records of slide-confirmed cases registered between 1982 and 1991 at Hospital Albert Schweitzer, a tertiary referral hospital in the rural Artibonite Valley of Central Haiti. The second was to assess the secular trend and cyclic occurrence of malaria cases over this time period, thereby providing an independent appraisal of official reports of a decline in malaria cases. In addition, the study had the secondary purpose of reporting the distribution of

malaria cases by age and sex and determining the proportion of malaria cases requiring hospital admission, the length of hospital stays, and rate of in-hospital malaria death in the period of 1989-1991.

## MATERIALS AND METHODS

The study used a hospital-based retrospective approach. It was conducted at Hospital Albert Schweitzer, the major provider of medical care to approximately 190,000 people living in a district of 610 square miles. The hospital also provides limited medical care to people living outside of the district; though this practice is discouraged to help manage the hospital's patient load. Geographically, the district consists of the Artibonite Valley, adjoining foothills and nearby mountains.

Most of the people served reside in simple thatch-roofed huts with one or two rooms or in concrete, tin-roofed houses. Approximately 80% of the valley is irrigated for the cultivation of rice and other crops. In contrast, farming in the foothills and mountains, depends on rainfall in June through August, when accumulation of standing water is fairly common.

At the hospital, 1989-1991 data on malaria patients were obtained by reviewing the facility's discharge summary cards, patient medical records, and laboratory records. (The number of cases available for review in this period was large enough to provide stable estimates of patient characteristics.) However, for cases diagnosed in 1982-1986 and 1988, only the laboratory records of malaria patients were reviewed. (The data for 1987 were unavailable, most likely due to misfiling of the record book.) Both in-district



and out-district patients were included in the study because laboratory records did not distinguish between patients by residence; however, few out-district patients are seen at the hospital.

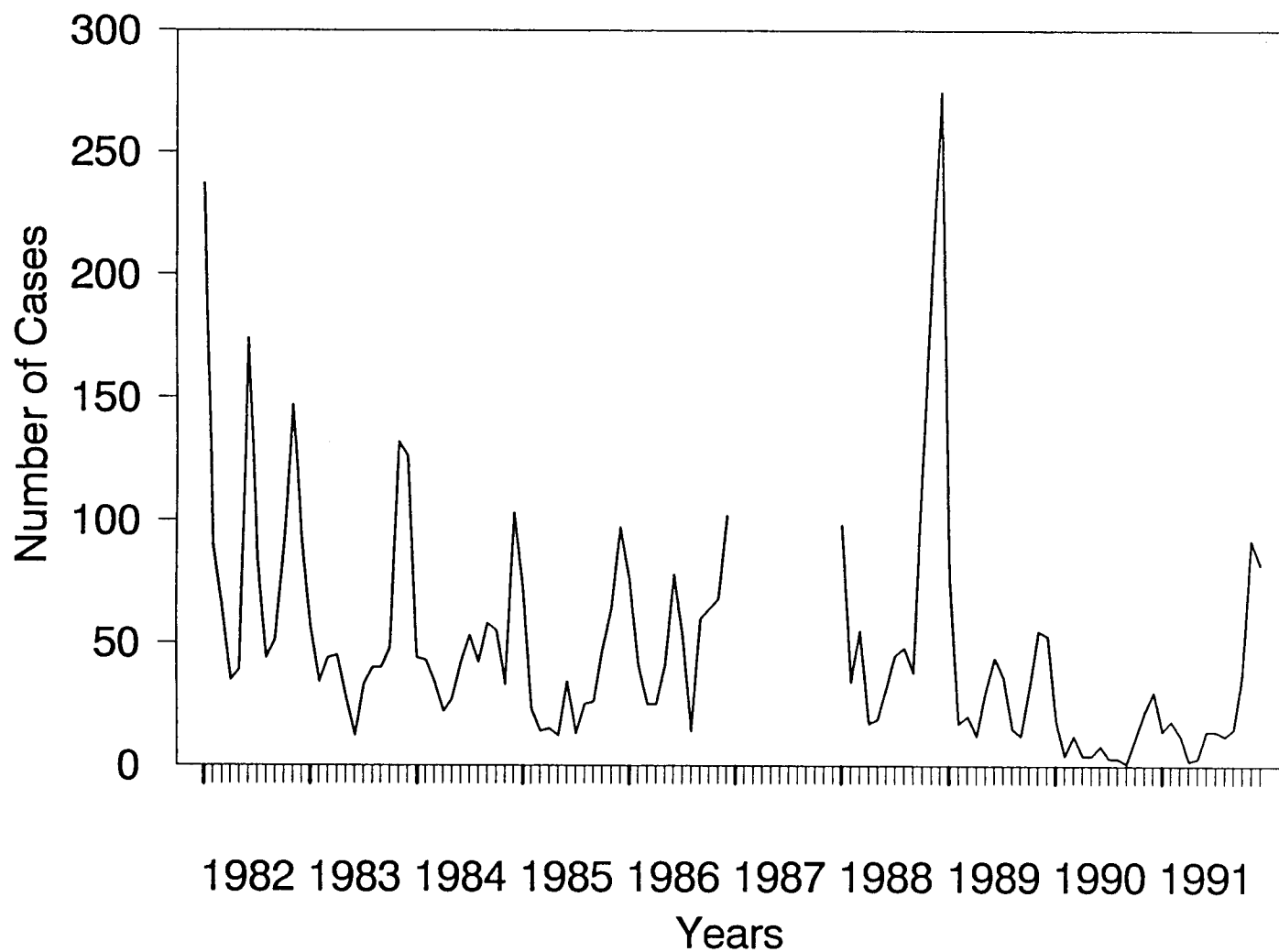
A positive blood smear combined with appropriate clinical findings provided the basis for a positive malaria diagnosis. When malaria was suspected, the laboratory routinely performed thick and thin blood smears to look for the malaria agent. For years the hospital has taken great pride in performing good laboratory work that is overseen by a well-trained department head. The procedures used by the laboratory to process and examine the thick and thin blood smears varied little if at all over the study period.

Patients treated for presumptive malaria in one of six rural primary health care clinics affiliated with Hospital Albert Schweitzer were not included in the study because these clinics lacked the resources to collect and examine blood smears. However, the clinics routinely referred their very sick patients to the hospital for treatment.

## RESULTS

Number of Cases Diagnosed, 1982-1991. The number of malaria cases per month that we found for the years 1982-1986 and for 1988-1991 are shown in Figure III 1. Overall, 5,251 cases were identified through examination of approximately 65,000 smears, the percentage of positive smears ranging from 14% in 1982 to 2% in 1990. The numbers of malaria cases diagnosed in specific years were highest in 1982 (1,150 cases) and in 1988 (980 cases), being lowest in the last two years studied (120 cases in 1990 and 317 cases in 1991).

In every year, the months when the peak numbers of cases were diagnosed occurred in the November-January period, a few months after a rainy season lasting from



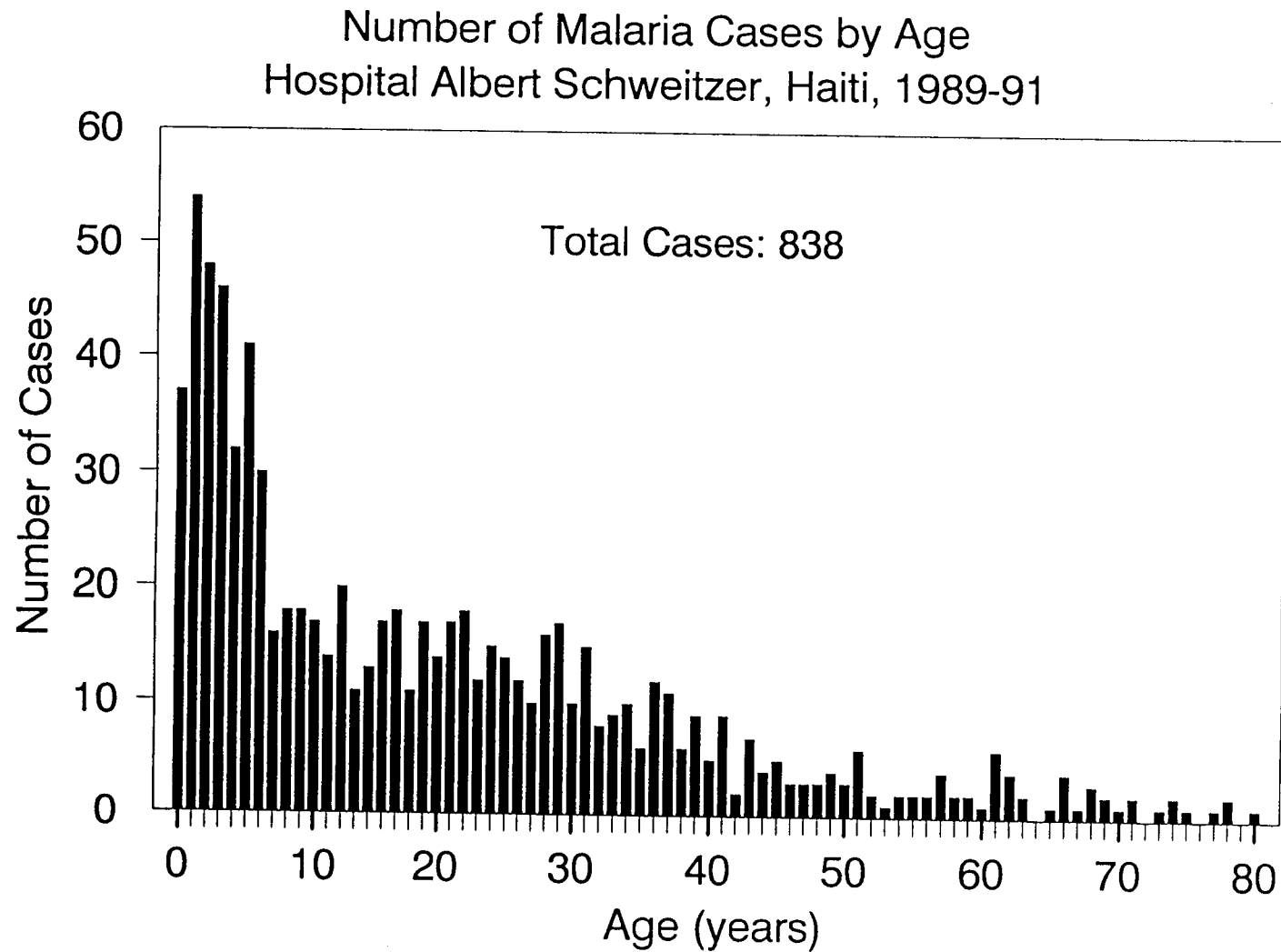
**Figure III 1.** The number of malaria cases found among patients attending Hospital Albert Schweitzer, by month, in the years 1982-1986 and 1988-1991 (N = 5251)

June through August. (Smaller malaria case peaks typically occurred in the June-July period). This consistent seasonal pattern occurred in both years with high numbers of cases (for example, in 1982 and 1988) and in years with a low numbers of cases (for example, 1990 and 1991), although the summer peak tended to be more pronounced in years with large numbers of cases.

Patient Characteristics, 1989-1991. Among the 838 patients with malaria cases diagnosed from January 1989 through December 1991, 53% were females and 47% males. Children 0-6 years old had the largest average number of cases of any age group, this average being 41.1 cases per year of age. In a similar vein, as Figure III 2. shows, the largest number of cases (54) in any one-year age group occurred among children 1 year of age. Beyond age 6, the average numbers of cases per age group were notably lower and tended to decline further with increasing age. Specifically, the average number of cases per year of age were 14.9 in the 7 to 31 year group, 8.5 in the 32 to 41 year group and 2.4 in the 42 to 80 year group.

Most (78%) of these 838 malarious patients resided within the health district of Hospital Albert Schweitzer. Of the other 22%, 12% gave addresses outside the district; data regarding the residences of the remaining 10% were not available. Most of the malaria cases occurred among residents of the Artibonite Valley proper rather than among residents of the surrounding foothills.

The great majority (725, or 87%) of the 838 subjects were treated as outpatients; only 113 (13%) required in-hospital care and were admitted. The hospital stays of these 113 ranged from 1 to 13 days, the median length being 3.3 days. Over a third (37%) of those admitted were children under 5 years old; 12% were children 6-10; 16% were children and young adults 11-20; and 35% were over 20. Nearly half (45%) of the 113 hospitalized patients were diagnosed as having cerebral malaria, a common consequence of *falciparum* infection, and were provided with appropriate treatment. Eight (7%) of



**Figure III 2.** The number of malaria cases, by patient age, found among patients attending Hospital Albert Schweitzer in the three year period 1989-1991 (N = 838).

the 113 died in the hospital as a result of malaria between 1989 and 1991. Five of these deaths occurred among children 0-6 years old, and six were attributed to cerebral malaria.

## DISCUSSION AND CONCLUSION

The study findings suggest that malaria is endemic in the Artibonite Valley and surrounding foothills, producing seasonal outbreaks with a relatively slack period in February-September and increasing morbidity beginning in October. Most of the diagnosed malaria cases affected people residing in the Artibonite Valley, where canals provide water for cultivating rice and other crops. As previously noted, approximately 80% of the valley is irrigated; and the irrigated fields, used throughout the year, provide good breeding habitats for the *Anopheles* mosquito (Schoof, Mathis, Brydon & Goodwin, 1966).

Infants and young children (under age 7) accounted for over a third of the 838 malaria cases studied, and the largest number of cases in any one-year age group occurred among children 1 year old. These findings are consistent with the conclusions of a number of studies performed in other areas. Specifically, in 1952 Bruce-Chwatt reported low grade parasitemia occurring perinatally in endemic areas in Africa, together with mild symptoms believed to be related to a passive immunity acquired from the mother. Later work, also in Africa, demonstrated that the parasite rate increased substantially between 3 months and 1 year of age and remained high during early childhood, a period when death rates declined markedly (Billewicz & McGregor, 1981). In 1969, Lucas and colleagues (Hendricks, Okubadejo, Richards, Neal & Kofie) reported that in an area where asymptomatic parasitemia occurred in up to 75% of a group 6 year

olds, school age children developed a protective level of immunity. More recently, adults living in highly immune communities were found to have a prevalence of parasitemia in the range of 10%-25% with low parasitemia density levels and few illnesses (McGregor & Wilson, 1988; Boudin, Lyannaz, Bosseno, Carnevale & Ambroise-Thomas, 1991). However, in areas of low endemicity the population tended to have little immunity, resulting in more severe individual malaria infections (World Health Organization, 1986; Oliveira-Ferreira, Nakaie & Daniel-Ribeiro, 1992). In a similar vein, a study of antibody levels and spleen sizes by Jones, Baird, Basri, Purnomo & Danudirgo (Indonesia, 1991) found mean spleen size to correlate positively with increased prevalence and negatively with low resistance. While these studies were not conducted in Haiti, it seems reasonable to assume that the conclusions are applicable because the prevalence peaked in one year olds.

In the present study, most people diagnosed with malaria were treated as outpatients. As a rule, those admitted and given inpatient care were seriously ill. Cerebral malaria accounted for most of the complicated cases and death, a finding consistent with the high prevalence of *P. falciparum* in our area. (The literature identifies cerebral malaria as a frequent cause of mortality in young children and in non-immune adults (Bruce-Chwatt, 1987; World Health Organization, 1986; Harinasuta & Bunnag, 1988; Greenberg, Ntumbanzondo, Ntula, Mawa, Howell & Davachi, 1989).

Two possible sources of error merit attention. First, the estimated number of malaria cases in the region may have been under-reported due to the lack of data from the rural primary health clinics where patients are treated for presumptive malaria and only referred to the hospital when critically ill. Although the magnitude of any such under-reporting is unknown, it could have introduced a detection bias into the study.

Second, data concerning the numbers of people at risk by sex, age group, and area of residence were not available. Thus, it was not possible to estimate malaria

prevalence. This is partly because the last updated population survey was conducted in 1982, and the last updated population estimate was provided by the Population Institute in 1987. It is also because movements of the rural population in the Artibonite Valley and its surrounding foothills and mountains are hard to access.

In times of political and economic hardship, people tend to go where they hope to better their lives. For example, between September 1991 and March 1992 a noticeable population influx from urban areas came to the small, isolated, mountain town of Hinche, a community within the hospital's district (personal observation from the Hinche health clinic, Dr. Saintely Dubuisson, 1993). Haiti has experienced political instabilities since 1986, and similar population shifts could have occurred from that time onward. (Despite political changes, the government clinics tended to remain open to serve the people.)

In addition, there is daily migration, either into or out of the study region, to trade produce in the markets. Depending on their departure and return times, hospital district residents traveling outside the district might be exposed to the malaria parasite elsewhere. Such exposure would tend to make the study conclusion about malaria's decline more conservative.

In 1983, WHO reported that Haiti appeared responsible for an increased malaria incidence in the neighboring Dominican Republic, due to ongoing emigration (World Health Organization, 1985). (Large parts of the Dominican Republic had moved into the malaria maintenance phase in the 1970's; and in 1975 only 60 cases were reported.) Subsequently, the number of cases in the Dominican Republic increased, 3,600 being detected in 1981 and 4,700 in 1982. (This cases count dropped back to 356 in 1990, possibly as the result of a drought--World Health Organization, 1992).

The current investigation at Hospital Albert Schweitzer supports official malaria case reports showing an overall decline in the number of malaria cases in this region of

Haiti served by the hospital between 1982 and 1991. Primary health care may have contributed to the decline-because during the 1980s the hospital's Community Health Department developed a strong primary health care program at the six rural clinics in its district. These clinics implemented level one of WHO's proposed strategy for malaria control, a strategy that includes four levels (World Health Organization, 1986). The level one measures emphasize prompt treatment of fevers, particularly in high-risk groups such as young children and pregnant women. WHO's position, supported by a study in Thailand is that prompt treatment of fever, even if such treatment results in over-treatment of some febrile illnesses, interferes with the life cycle of the malaria parasite, thus contributing to reduction of malaria transmission and ultimately of malaria cases (Declut, Pecoul, Biberson, Lang & Imivithaya, 1991). The chloroquine sensitivity of Haitian parasite strains (in contrast to the chloroquine resistance found in most African and Asian strains) would also have tended to support case reduction through treatment.

In addition to public health measures, the aforementioned 1990 drought in the Dominican Republic may have contributed to reduced malaria in the Artibonite Valley, because the Artibonite River receives its water from the mountains of the Dominican Republic (World Health Organization, 1992). Low water levels in the Artibonite River reservoir may have reduced the acreage irrigated and, consequently, the vector mosquito habitat. Overall, the findings of this investigation support official malaria case reports showing a general decline in the number of malaria cases in the region served by Hospital Albert Schweitzer during the study period.



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