5.0 SEXUALLY-TRANSMITTED DISEASES (INCLUDING AIDS AND HEPATITIS B-D)

5.1 HEPATITIS

Viral hepatitis is a general category for a diverse but related group of infectious agents that are extremely common in Sub-Saharan Africa in general and Cameroon in particular. Hepatitis viruses B, C, and D can all be transmitted via sexual contact. Percutaneous and premucosal exposure to infective body fluids e.g. blood, saliva, semen, and vaginal fluids, are primary transmission routes. Hepatitis A (HAV) is not a sexually transmitted disease but is included in this section for completeness.

5.1.1 Hepatitis Type A (HAV)

Type A (HAV) is highly contagious, usually transmitted by the fecal-oral route and from contaminated food, milk, and water. There is no carrier state for Hepatitis A Virus (HAV), perpetuation of the virus in nature appears to depend on nonepidemic, inapparent subclinical infection. In Cameroon, 91.4 percent of subjects in one large-scale study were anti-HAV positive. None of the study subjects had anti-IGM antibodies to HAV which confirms the early occurrence of HAV infection in Cameroon (Ndumbe, 1989, 1994). In Cameroon, the high and early occurrence of HAV is attributed to poor hygiene standards (Ndumbe, 1994).

5.1.2 Hepatitis Type B (HBV)

In SSA, intimate contact among young infants/children is associated with a high frequency of hepatitis B surface antigen (Hb_sAg). Perinatal transmission occurs in infants born to Hb_sAg carrier mothers or mothers with acute HBV during the 3rd trimester of pregnancy or during the early postpartum period. Sexual transmission is also quite prominent. In Ndumbe's study (1994) of 369 pregnant women in a rural hospital in Manyemen, Cameroon, 5.4 percent were Hb_sAg positive.

For Hb_sAg, the highest prevalence was seen in the 10-19 year age group, where 10.5 percent were positive. The incidence of prior HBV infection was extremely high with 85 percent of the women demonstrating evidence of previous exposure to the virus based on the prevalence of anti-HB_C (Ndumbe, 1994). Similar rates (up to 10 percent) have been found in urban Yaoundé demonstrating that the high prevalence rates are not an isolated rural phenomenon (Ndumbe, 1989, 1991, 1994). Comparable Hb_sAg in the US are 0.1 - 0.5 percent. In Mayo-Sava (Extreme North) Hb_sAg rates were 25.3 percent (Merlin and Josse, 1985) and in the West Province 8.5 percent (Aebischer, 1990).

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5.1.3 Hepatitis Type C (HCV)

Formerly known as non-A, non-B hepatitis, HCV is the cause in more than 90 percent of cases of transfusion-associated non-A, non-B hepatitis. The prevalence rate of HCV infection in the adult SSA population is extraordinarily high when compared to the Established Market Economics (EMEs). In the EMEs, HCV ranges from 0.5 to 2 percent in blood donor groups (Mencarini, 1991).

Mencarini et al. (1991) evaluated the prevalence of HCV infection in a group of 315 normal subjects living in various regions of Cameroon: a) Extreme North, Amoré department, b) North - town of Garoua, c) West - Mifi department and d) Littoral - Moungo department. Prevalence rates were strongly correlated with age but not sex. There was a higher prevalence in the northern Provinces; however, there were no significant difference in prevalence between samples from rural or urban environments (Mencarini, 1991). Figure 39 presents the results of this study. The overall prevalence rate was 9.8 percent. This extremely high rate triggered further investigations in many other locations and study populations.

Ndumbe and Skalsky (1993) found a 5.5 percent prevalence in pregnant women in Yaoundé and a 6.8 percent rate in a similar group in the rural hospital in Manyemen (Ndumbe, 1994). The variability of results has been attributed to the different assays used by investigators (Nkengasong, 1995; Tibbs, 1991). Nkengasong et al. argued that previous studies carried out in some tropical countries used first generation enzyme immunoassays (EIAs) and were flawed because of poor sensitivity and specificity of the assays.

Since the development of second and third generation HCV EIAs, sensitivity has greatly improved. Confirmation testing by radio-immunoblot assays (RIBA) has reduced the number of false positives. Overall, most studies in the last 2 to 3 years use a combination of second or third generation enzyme linked immunosorbent assay (ELISA) plus RIBA confirmation. Nkengasong, et al., performed a prevalence study on 251 individuals originating from Ebolowa, an urban area in southern Cameroon near the pipeline corridor. Table 31 shows the prevalence of anti-HCV antibody in the different study groups. As illustrated in this table, the overall prevalence of HCV was extremely high and demonstrated a marked correlation with age. A statistically significant difference between sexes (33 percent males and 25 percent females) was not present.

There are several mutually nonexclusive explanations for the high prevalence rates:

- Ritual scarification and tattooing
- Use of nondisposable or poorly sterilized skin-piercing medical equipment
- Possible role of transmission through an insect vector. HCV is a flavinirus. Other infections in this family are known to be arthropod-borne.

- Blood donation/transfusion
- Sexual transmission.

Based on this study, the authors dubbed HCV as a possible "sleeping giant in Southern Cameroon." (Nkengasong, 1995).

In order to further explore the HCV problem, additional studies have been performed in several villages in southern Cameroon (Kowo, 1995; Louis, 1994b and 1994c). These studies are particularly interesting because they studied relatively isolated rural populations of Baka Pygmies and Bantus (e.g. Boulous and Fangs). The overall results of Kowo, et al., (1995) are shown in Figure 40 and those of Louis et al. in Table 32.

According to Kowo et al., the overall prevalence rate of 13 percent found in a forest population of southern Cameroon is probably one of the highest known worldwide, using the new generation assays (Kowo, 1995). There was a significant difference between Pygmies and Bantus. Since Pygmies are monogamous and relatively isolated, it is less likely that HCV was acquired from the outside versus low efficiency continuous transmission. This study also found that 7.2 percent of the subjects were Hb_sAg carriers, a rate that was previously discussed, is within the levels observed throughout Cameroon. Interestingly, there were no confirmed cases of HIV or Human T-lymphotropic virus (HTLV) infection.

The Louis et al. studies (1994b and 1994c) included: 1) 807 residents (ages 5 and greater) of 5 villages in the Djoum area, 2) 771 (ages 15 and greater) residents of Balu du Dja (Mékas) and, 3) 608 individuals (age 15 and greater) who lived along the Yokadouma-Mouloundou route. The overall prevalence rate in Djoum was 12.5 percent for all ages, but there was a marked difference in the age 15 to over 70 Bantus (21.1 percent) and the similar aged Pygmies (2.86 percent). High rates in ages 15 - 70 were also seen in the Mékus Bantu group (40.36 percent) (Table 33). The Yokudouma (age 15 - 70) Bantus had substantially lower prevalence rates (7.5 percent) (Table 34). The explanation for these differences is not known.

The Pygmies in the Mékas study had a HTLV-1 confirmed (western blot) positive rate of 1.5 percent (Louis, 1994b). Additional Pygmy studies have been published involving the Baka Pygmies of the East Province (Ndumbe, 1993) and the Bakola Pygmies of the Ocean Department (Campo-Bipindi area) (Delaporte, 1994).

In the East Province study of 141 subjects (ages 18-45), the prevalence of Hb_sAg was high (14.2 percent). Exposure to the hepatitis B virus on the basis of anti-HB_C was 93.5 percent. The prevalence of HCV antibodies was 7.9 percent. Anti-HDV antibodies were found in 45 percent of the study subjects. Approximately 13.4 percent had antibodies to syphilis. HIV-1 was 0.7 percent or one case out of 140 samples, while HTLV-1 was 10.9 percent (15 out of 138).

In the Bakola Pygmies, HCV prevalence was 8 percent (Delaporte, 1994). Syphilis was endemic with a 55 percent positivity rate; however, the biological test could not differentiate between yaws and venereal syphilis. The HIV/HTLV status of the Bakola Pygmies will be discussed in detail in the next section, since the pipeline corridor will pass through the Lolodorf-Bipindi-Kiribi area.

Overall, the HCV epidemiology in Cameroon and SSA has been recently reviewed by Deparis et al. (1996). These authors, (which include F.J. Louis and M. Merlin) make several interesting observations:

- The endemicity of HCV can be categorized on a regional basis
  - hyperendemic - Central African States
  - mesoendemic - Sahelien Zone, Northern
  - hypoendemic - Southeastern States
- The impact of HCV on chronic liver diseases appears to be independent of HBV. Unlike HBV there does not appear to be an impact between HCV and liver cancer.
- The HCV epidemic appears to have evolved independently from the epidemic curve produced by HIV. The age distribution patterns are quite strikingly different.
- The HCV seroprevalence increases with age in SSA, i.e. low before age 15 and maximum after age 40. HBV reaches high levels in SSA around age 15.
- Sexual transmission of HCV appears weak but not negligible.
- The possibility of a vector borne transmission of HCV in Central Africa exists but will be difficult to firmly prove.

An overall map of the HCV studies in Cameroon is presented in Figure 41.

5.1.4 Hepatitis D

The hepatitis delta virus (HDV) was first observed in Italian drug addicts in 1977. HDV was eventually shown to be a defective virus particle that could only grow in the presence of the hepatitis B virus surface antigen. Ndumbe (1991) performed a study on the prevalence of HDV and its risk factors in the Yaoundé area. Sera from 110 Hb_sAg subjects were tested for HDV infection (antibody and antigen): a) 43 pregnant women; b) 23 prostitutes; c) 20 patients with febrile jaundice; d) 16 multi-transfused sickle cell children; and e) 8 medical students. Overall results are shown in Table 35. This study demonstrated that HDV infections exists in Hb_sAg positive patients in Yaoundé. The two dominant risk factors are blood transfusion and sexual exposure.

5.1.5 Hepatitis E

Hepatitis E is an enterically transmitted (fecal) virus that is an important cause of large epidemics of acute hepatitis in India, Asia, the Middle East, and Northern Africa. HEV has not been reported as a major source of disease in Cameroon.

5.2 INTRODUCTION - HIV/AIDS

The Human Immunodeficiency Virus (HIV)/AIDS epidemic is not a monolithic phenomenon across the globe. The epidemic is composed of many separate and individual epidemics that are spread unevenly across regions such as SSA. Thus, characteristics such as geography, the type and nature of the population affected, the frequencies of risk behaviors and practices and the temporal introduction and amplification of the virus all have a profound affect on the magnitude and spread of the epidemic (Cohen and Trussell, 1996). Furthermore, there are biologic factors that can have profound impacts on the spread of the epidemic by increasing or decreasing the susceptibility to the virus, altering positively or negatively the infectiousness of those with HIV, and changing the progression of infection to death and disease (Cohen and Trussell, 1996). These biological factors include: the presence of classical STDs, e.g., genital ulcers, syphilis, etc., male circumcision, the simultaneous infection with other immunologically interactive diseases, e.g., malaria and the other tropical diseases, and the viral characteristics of HIV-1, HIV-2, and their multiple genetic strains (Cohen and Trussell, 1996 and Fauci, 1996). HIV-2 is a closely related human immunodeficiency virus which is primarily found in West Africa. Both sexual and mother-to-child transmission of HIV-2 are less efficient than for HIV-1. Not surprisingly, HIV-2 prevalence levels have remained relatively stable.

In order to better follow and understand both the data that will be presented and the subsequent discussion, there are several technical terms that must be clearly understood. HIV or human immunodeficiency virus refers to infection. For example, an individual can be exposed to the HIV virus and subsequently become infected. However, this infection does not necessarily produce clinical signs and symptoms and is detectable only by laboratory testing. Therefore, HIV prevalence and incidence rates refer to the number of persons currently infected or likely to become infected in a given time period. AIDS, or the acquired immune deficiency syndrome, refers to active symptomatic disease. Since there can be an extremely long period of time between infection and development of active disease, the number of HIV positive individuals is significantly different from the number of verified AIDS cases.

5.2.1 HIV/AIDS in Sub-Saharan

As a region, in a relatively short period of time (since 1981) there has been a massive epidemic of virtually unprecedented proportions that has affected SSA. It is estimated that there are over 11 million HIV-infected African adults and 3 million AIDS-related deaths as of 1995 (WHO, 1995).

By the year 2000 estimates are that 20 million individuals will be HIV-infected and at least 8 million will have died of AIDS. As many as 1 million African children are estimated to have been infected as a result of mother to child transmission (Cohen and Trussell, 1996). Estimates of the doubling time of the epidemic in SSA range from 1-3 years in high (20-30 percent) prevalence regions to 5 years or more in areas that have lower (10 percent or less) prevalence rates (Potts, 1991). The variability in prevalence rates is multifactorial: 1) presence of other active STDs, 2) differences in sexual behavior, e.g., number of partners, use of condoms, 3) contact between low-risk and high-risk groups, i.e., the pattern of mixing between groups with various degrees of sexual activity, 4) probability of transmission from an infected individual to his/her partner, and 5) timing of sexual contact during the highly variable incubation period of AIDS (Robinson, 1995).

Recent evidence indicates that life expectancy rates are declining in some of the most severely affected countries (US Bureau of the Census, 1994). In a prospective cohort study in rural Masaka District, Uganda, the HIV-1 epidemic has had a measurable and dramatic impact on adult mortality even though the overall prevalence (8 percent) and incidence (1 percent) rates were relatively low (Mulder, 1994). The projected cumulative effect of the HIV/AIDS epidemics is enormous. As this study demonstrates, the prevalence and incidence rates do not have to be extremely high for major impacts. As countries, such as Cameroon, move from low prevalence (1 to 5 percent) status to higher levels (8 to 15 percent prevalence), the expected effects will be potentially staggering.

Initially, HIV prevalence was not uniformly distributed across all SSA countries. This was illustrated by 1990 data (Figure 42). As shown in Figure 42, the epidemic disproportionately affected East and Southern Africa where up to one in three adults were infected in certain urban populations. The density of cases in West Africa was, as of 1990, substantially lower except in Abidjan, Cote d'Ivoire where high levels of infection, i.e., greater than 10 percent, were found. As a general finding, rates were lower in rural settings compared to urban locations. The highest rates were usually found in men and women between 20 and 40 years old and in people with STDs and TB. There was a marked occupational bias with high rates in long-distance truckers, military personnel, and women employed in the commercial sex industries. These groups are known as "high-risk" populations. "Low-risk" populations include pregnant women and the general population. There was a marked difference in the age distribution of peak HIV prevalence between men (older) and women (younger) because sexual partnerships tend to be formed between older men and young women. There were differences in male-to-female and female-to-male transmission rates with the former being more efficient than the latter. Therefore, as the epidemic spread into the rural population, the absolute number of infections became higher among women than men (Cohen and Trussell, 1996). It is illustrative to compare the 1990 African seroprevalence data with more recent prevalence mapping studies from 1995, January 1997, and June 1998. Figures 43 through 46 are 1995 data. It is obvious that the HIV prevalence has significantly increased across all of SSA and particularly in the Central African States (including Cameroon). This latter observation is illustrated in Figure 47.

January 1997 prevalence mapping demonstrates the inexorable increase and spread, particularly in the low-risk urban populations, of HIV-1 (Figures 48 and 49). HIV-2 has remained relatively stable (Figures 50 and 51). As these maps clearly illustrate, Cameroon has moved from a low prevalence (<5 percent) country to a much higher prevalence situation that is similar to its neighboring countries (Figure 52). July 1998 data again demonstrates that rates are inexorably increasing (Figures 53 - 57). A detailed analysis of this transformation in Cameroon will be presented in latter sections after basic information on the transmission and amplification of HIV is introduced.

5.2.2 Transmission and Amplification

The analysis of the basic reproductive rate of infection is similar to the calculation of the malaria BCRR (Section 4.6.1). The basic reproductive rate of infection, Ro, within low risk groups is probably less than unity (1.0). Ro defines the average number of secondary cases generated by one primary case, with Ro>1 needed for epidemic propagation to occur (Cohen, et al., 1996). Therefore, if low-risk groups, e.g., rural population, come in contact with high-risk groups, e.g., commercial sex workers and their male clients, the opportunity to generate an epidemic is substantial. For example, the altered contact and mixing of different subgroups that can occur between truckers, their contacts and then their spouses and/or girlfriends can amplify the basic case reproduction rate. For example, Carswell et al. in a 1989 study of East African truck drivers argue that although commercial sex workers have high prevalence levels of HIV, it is the contact with travelers from other parts of Africa, initially confined to major trading routes and highways, that acts as the portal of entry for HIV into a given region (Carswell, 1989; Hunt, 1989). Analogously, small changes in the pattern of mixing between sexual activity classes can also slow, or even prevent an epidemic that would otherwise be widely disseminated (Potts, et al., 1991). Similarly, treatment of active STDs would also have a beneficial impact of approximately 40 percent reduction in HIV incidence (Grosskurth, 1995a, 1995b).

The basic biological and behavioral factors that determine the transmission dynamics of HIV and the other STDs have been well described in a number of publications (Anderson, et al., 1988; Auvert, 1990; Over, et al., 1993; Potts, et al., 1991; Royce, 1997). The observations and models discussed in these papers are all fundamentally based on the relationship between Ro- the reproductive rate or the number of new infections transmitted by one infected person in the susceptible population and three determinants referred to in the literature by two different but synonymous symbols of the rate of spread: 1) or Q, which represents the mean probability of sexual transmission per partnership; 2) D, the mean number of years an infected person remains infectious and 3) c or a, the average rate of new sexual partner selection per year or the number of contacts per time period between an infected person and a susceptible person (Cohen, et al., 1996). The relationship is linear, i.e., Ro= cD or Ro=QaD. In a 1993 article, Over

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and Piot present some of the basic values for each determinant of Ro based on several assumptions regarding the study groups and the simulation under consideration (Jamison, 1993). The most important measure of sexual behavior is c, the rate of sexual partner change within a population. The variable "c" is not the average or mean number ( ) of new sexual partners per person but instead is +variance/ , where variance refers to number of new sexual partners per year. The variable "c" is then a reflection of the heterogeneity in sexual behavior, as measured by the variance of sexual partner change (Over, et al., 1993). This quantity is larger than the average number of new partners and adds substantially to the reproductive rate and hence, the likely future growth rate of the epidemic. Therefore, both mean and variance matter and the few individuals with many partners ensure that infections spread rapidly (Cohen, et al., 1996). This observation illustrates why female commercial sex workers, their clients, truck drivers, migrant workers, and the military form a potent high risk core group capable of amplifying transmission rates in a population that has relatively low prevalence.

Based on initial work by Auvert, et al., (1991), Robinson (1994, 1995) developed a simulation model for the transmission dynamics of HIV infection and STDs. This model called SimulAIDS, represents a significant enhancement of the ability to model both projected transmission rates and effects from various intervention strategies. The Robinson et al. (1994,1995) project had general unique and important features: 1) it was based on a specific rural African cohort of 10,000 in southwest Uganda where the British Medical Research Council had collected extensive data form 1989-90; 2) it simulated transmission dynamics of HIV and two other STDs (ulcerative and non-ulcerative); 3) it analyzed and modeled the proportion of HIV infections attributed to selected STDs; and 4) it assessed the effects of a range of intervention strategies.

The basic shape of the HIV epidemic is a sigmoid curve with a maximum equilibrium level based on infection and death rates. The infection rates are a complex product of behavioral and unique societal characteristics (Caldwell, 1993). Figure 58 is a simulated HIV prevalence curve in adults from Robinson's analysis (1994). A similar projection for Cameroon, based on the DEMPROJ (demographic projection) model was published by Garcia-Calleja (1992a, 1992b). These projections, shown in Figures 59 and 60 are similar in shape to Robinson's curves, but use different starting dates and input parameters. Both projections show a peak prevalence approximately 10 years after the start of the epidemic.

The Cameroonian projections indicated that the 1991 - 1992 time frame would be the peak period. All available data indicates that this is not the case. Cameroon had generally been considered a low prevalence country (less than 5 percent prevalence) but data from 1992-1996 clearly shows that this is no longer the case. These discrepancies are multifactorial and may be due to improvement in data collection, HIV diagnosis, and in the record keeping system. Nevertheless, it appears that Cameroon was in a pre-epidemic phase from 1985-1991 and may well be entering an epidemic period between 1996-2000. Thus, HIV prevalence curves would be right-shifted along the x-axis; however, the fundamental sigmoid-shaped curve would remain.

The ability to impact these prevalence curves will be presented and discussed after the 1985-1997 Cameroon-specific data is presented in the next section.

5.2.3 CAMEROON HIV/AIDS DATA: 1985-1997

Cameroon reported its first AIDS case in 1985. Since then, the number of reported cases has continued to rise (Table 36). The characteristics of the epidemic in Cameroon are similar to those seen in SSA (Garcia-Calleja, 1992a and b), where the main mode of transmission is heterosexual. The primary targets of the epidemic have been urban young and sexually active ages 15-40 (Figures 61 and 62). In 1987, there was neither strategy nor national program to combat the spread of HIV infections (Baer, et al., 1994). In 1988, the Government of Cameroon (GOC), initiated a National AIDS Committee to develop a HIV/AIDS prevention and central strategy. In 1988, sentinel surveillance began in six locations: 1) Yaoundé, 2) Bertoua, 3) Garoua, 4) Bamenda, 5) Limbé, and 6) Douala. These sentinel sites initially analyzed data from low-risk pregnant females. Data from 1989-92 are shown in Figure 63 while the most recent data, 1992-96, are seen in Figure 64 (HIV), Figure 65 (Syphilis prevalence rates), and Tables 37A - B. As illustrated in these tables and figures, HIV prevalence rates in low-risk pregnant females have significantly increased, from an overall 3.0 percent rate in 1992 to are 5% percent in 1996 (MOPH, 1998).

During the 1988-1996 time period, two five-year Medium-Term Plans (MTP) were established: a) MTP-1, 1988-1992 and b) MTP-2, 1994-1998. A comprehensive review of the overall program occurred in 1993. Throughout the entire period of both MTPs, there has been extensive multi-donor support e.g. USAID, World Bank, ORSTOM, German Technical Cooperation Agency (GTZ), etc. As a result of both GOC and multi-lateral agency efforts, there have been a tremendous number (over 300) of HIV prevalence studies performed throughout Cameroon. Figure 66 is a map of the HIV study locations that have been reported in the published literature. Based on this map, the number of study sites appears to be quite extensive in the Southern and Western Regions of Cameroon. This observation is true but somewhat deceptive as there have been numerous studies in the Center, Adamoua and North Provinces. However, many of these studies are rural population surveys that were not focused on a specific city location since the population density is extremely low in most areas of these Provinces (Table 4). Therefore, these studies do not appear (Figure 66) as a discrete point location. As this map illustrates, there is a wide geographical distribution of the study locations; furthermore, there are a variety of sub-populations within each study. Data from some of the most important surveys will be presented in the next subsections.

5.2.3.1 Subpopulation: Low-Risk

Based on data collected by the US Bureau of the Census, International Programs Center Population Division (hereinafter referred to as IPC) the various sampled populations can be divided into two groups: a) low-risk - pregnant women, blood donors and other general population surveys; b) high-risk - commercial sex workers or prostitutes (CSW), STD clinic patients, military personnel and truckers. This categorization is arbitrary but useful and is based on the general likelihood of a defined group engaging in unprotected sex with multiple partners. Low-risk does not imply no risk since pregnant women are obviously sexually active (IPC, 1995).

Data from studies on pregnant women are presented in chronological order in Table 38 (IPC, 1999). Some of the salient features of these data are graphically shown in Figures 67 and 68. These data indicate that rates have significantly increased over the five years from 1990 to 1995 i.e., 0.5 percent in 1987 to over 5 percent in 1996 (MOPH, 1998). In the major sentinel surveillance sites, some prevalence rates have increased by 3-10 fold, indicating that Cameroon is moving out of the pre-epidemic phase and into an epidemic period.

Similar data are seen in blood donors (Table 39 and Figure 69). General population studies (Table 40) for 1985-1994 also indicate that Cameroon is moving from a very low prevalence condition to medium (5-10 percent) prevalence status (Garcia-Calleja, et al., 1993; IPC, 1995 and 1997). Data from a recent 1996 study in Batouri (Remy et al., 1996) confirms this observation where rates have increased from no detectable cases in 1991 to 1.7 percent in men and 4.1 percent in women.

5.2.3.2 Subpopulation: High-Risk

Seropositive rates in CSW have skyrocketed over the ten year period from 1985 to 1995 (Table 41 and Figure 70). In 1992, CSW had overall rates of 35 percent seropositivity in Cameroon (IPC, 1995). There rates have undoubtedly continued to rise. A recently published study in Mbaimboum (North Province) confirms this alarming trend (Chambon 1994a, 1995a and b). In the Chambon et al. study, 54.8 percent of the CSW were seropositive. In addition, the rates in single women (24.5 percent), men (6.8 percent) and truckers (24.5 percent) were at the highest levels seen in Cameroon. Mbaimboum is a 10,000 inhabitant town at the junction of Cameroon, Chad and the CAR. This town appeared to rapidly develop as a commercial and transportation crossroad. As such, Mbaimboum is unfortunately well situated to act as a dissemination reservoir to the surrounding rural areas (Chambon, 1995a).

Two other 1993 studies in truck drivers also demonstrate high seropositivity (Table 42). A 1996 study in Douala and Ekok of truck drivers found 15.2 percent seropositive rates (Sam-Abbenyi, 1996). According to data from the MOPH, overall trucker rates were 17 percent at the end of 1995 (MOPH, 1997). Truck drivers represent the third highest seropositive group in Cameroon after CSW (at least 35 percent) and inmates in Douala prison (20 percent) (Sam-Abbenyi, 1996). Two other high risk groups are patients seen in STD clinics (Table 43 and Figure 71) and military/police (Table 44). The rates seen in these two groups are both higher than general adult surveys but are below the extremely high levels seen in CSW and truckers. Data from the MOPH (1997) puts military/police seropositive rates at 6.5 percent. The STD patient rates are critical because the simultaneous presence of other STDs appear to act as a major cofactor in accelerating the spread of HIV. Table 45 summarizes the results for the high risk groups based upon 1998 MOPH data.

5.2.3.3 Subpopulation: Pygmies

There have been several HIV seroprevalence studies of the Baka and Bakola Pygmies (Table 46). In a previous section that discussed Hepatitis C Virus (Section 5.1.3) many of the unique characteristics of the Pygmy groups were presented. HIV rates in Pygmy populations have consistently been below 1.6 percent. While other diseases, such as Hepatitis B and C, are quite prevalent, to date, the Baka and Bakola Pygmies have not been significantly impacted by HIV.

5.2.3.4 Subpopulation: Variants

Worldwide, there are at least nine identified subtypes of HIV-1, i.e., A-H and O (Brodine, 1995). These subtypes are variably dispersed and intermixed geographically. While subtypes A, C, and D are the most common in Africa, the epidemiology of HIV subtypes in Cameroon is more complex. Most of the known HIV-1 Group M (major) subtypes have been identified in Cameroon. Cases of infection by highly divergent Group O strains (O for outlier) have been found almost exclusively in patients of Cameroonian origin (Mauclère et al., 1997). The importance of this genetic heterogeneity is unknown; however, different subtypes may have impacts on the epidemiology of transmission and amplification (Brodine, 1995). Burke and McCutchan (1996) have challenged the conventional view of the HIV epidemic that is based on a single emergence of a simian (monkey) immunodeficiency virus (SIV) into humans some years ago with a gradual mutation and global spread. These authors feel that the global HIV epidemic can be best understood by a chaotic model:

- Divergence - the current HIV pandemic is composed of at least five major virologically and geographically distinct sustained subepidemics
- Dispersion - international HIV-1 dispersions are commonplace, but only some become sustained regional epidemics
- Adaptation - HIV-1 independently continues to adapt to local host populations. HIV has a high replication error frequency (i.e. 1 million-fold greater than human DNA genome) and high replication rate.

The implications of these assumptions are that new variants are continually generated, any one of which, under the right host setting, could become the next major epidemic. The implications for vaccine development are profound; however, the clinical, diagnostic, and intervention implications are equally serious (Mauclère, 1997).

5.2.4 Intervention Strategies

In SSA, the transmission of HIV is clearly enhanced by the presence of multiple sexual and non-sexual factors: 1) sexual contact in the presence of other STDs; 2) lack of use of condoms; 3) sexual contact during menses; 4) use of desiccating substances in the vagina; 5) low rates of male circumcision; 6) non-sterile injections and scarifications; 7) transfusions; 8) mother-child infections; and 9) pre-existing immunologic compromise due to other parasitic disease, e.g. malaria.

Each of these cofactors either singly or in combination influence the rate of HIV transmission. Similarly each potential cofactor presents an opportunity for an active intervention strategy directed towards decreasing transmission and amplification. The literature on HIV/AIDS intervention strategies is voluminous (Oakley, 1995; Pepin, 1989; Allen, 1992; Green, 1995; Cohen and Trussell, 1996). As previously mentioned, Robinson et al. (1994, 1995) performed a series of simulations based on different "packages" of interventions: 1) treatment of STDs, 2) condom use, 3) behavior modification, 4) STD and condom, 5) STD and behavior, 6) condom and behavior, and 6) all interventions. Projections were modeled assuming 25 and 50 percent effectiveness of the various packages of interventions. Figures 72 through 75 show the output of these simulations based upon the various packages of interventions. Dramatic reductions up to 82 percent in long-term HIV prevalence were projected for the high cofactor multiple intervention scenarios at the 50 percent level. Confirmation of the impact on HIV transmission via STD treatment interventions has been recently published (Grosskurth, 1995a, 1995b). This large clinical study clearly indicates that the treatment of STDs can significantly decrease (up to 40 percent) the transmission of HIV. Therefore, it is likely that other intervention strategies e.g. condoms, behavioral (information, education, communication [IEC]) coupled with STD treatment could achieve similarly dramatic results. A review of the Knowledge, Attitudes and Practices (KAP) literature is ongoing and will be incorporated into and presented within the overall STD mitigation and management plans. Cameroon has several ongoing IEC intervension studies that have published recent results in both the village and workplace setting (Etame, 1998, Epanya, 1997).