The effects of an individualised cognitive-behavioral and electromyographic feedback intervention on HIV-seropositive patients

by

LAMBROS MESSINIS

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ABSTRACT

The Acquired Immunodeficiency Syndrome (AIDS) has taken on pandemic proportions world wide, providing the health care system with the greatest challenge since its existence. At present, infection with the Human Immunodeficiency virus (HIV) is incurable, fatal and dangerously contagious influencing the health of the public as well as exerting profound effects on political, social and economic circumstances of the world.

The challenge was and still is, to develop an effective treatment method for Human Immunodeficiency Virus (HIV) infection and /or Clinical AIDS. Up to the present time no effective treatment method has been found, as the retroviral agents typically only cause a temporary inhibition of the progression of the HIV and not a permanent cessation of the activity of the virus. In the absence of any pharmacological treatment, behavioral interventions and in particular biopsychosocial interventions utilizing cognitive-behavioral therapy and ergometric aerobic exercise take on particular importance as adjunctive treatment methods, especially during the asymptomatic and early symptomatic HIV, (CDC stages 2 and 3 and WR stages 2-4 A), but non-Clinical AIDS stages.

Adding Electromyographic-feedback assisted relaxation training to the above therapeutic modalities increased the likelihood of addressing specific physiological variables associated with HIV-seropositivity, and served as a direct operant intervention in indirectly enhancing immune system functioning, through psychophysiological mechanisms or by means of the relaxation effect which it produces.

In South-Africa the HIV\ AIDS situation is further compounded by a number of social and economic factors in a society expressing rapid political changes against a background of apartheid. Herein, issues of poverty, violence, proper medical care for HIV sufferers, especially in the rural areas where antiviral medications and other health services are not easily accessible, inadequate housing and unemployment place even greater burdens on the already under-served HIV sufferer. With the above aspects in mind and considering the seriousness of the AIDS pandemic in South-Africa as well as the absence of effective pharmacological agents in curing this disease, an 8-week combined biopsychosocial treatment intervention utilizing individualised cognitive-behavioral therapy, aerobic exercise and Electromyographic-feedback assisted relaxation training was developed.

The objective of this research was to determine whether the combined biopsychosocial treatment intervention that had been developed would serve as a successful adjunctive treatment method to the present pharmacological treatments, especially during the asymptomatic and early symptomatic stages of HIV-infection where the apparent sluggishness of immunological functioning may be most amenable to interventions that enhance effector functions and communication between CD4 T-lymphocytes, CD8 T-lymphocytes, macrophages and B cells via increases in lymphokine production.

The intervention further aimed to decrease depression, physiological tension and anxiety and fatigue levels, as well as increase vigor-activity levels important in the overall health status of HIV-seropositive patients. The intervention was implemented on a group of South-African asymptomatic and early symptomatic (CDC stages 2 and 3 and WR stages 2-4 A) HIV- seropositives.

The results of the research revealed no statistically significant between-group differences in any of the cellular immune measurements. Clinically and statistically significant within-group differences were however found in baseline to post-test measures of total lymphocyte counts in subjects of the experimental group. Statistically significant between-group differences were also found in the tension-anxiety, depression-dejection, fatigue-inertia and vigor-activity levels of experimental subjects as compared to control group subjects. The study further found that subjects who recorded lower depression and tension-anxiety levels at baseline and post-intervention phases had higher CD4 -T lymphocyte counts and therefore, increased resistance to HIV-related infections and diseases. The study also revealed significant within-group differences in terms of the baseline to post-test relaxation effect of the EMG-feedback assisted relaxation training, as well as clinically significant within-group increases in the CD4-T lymphocyte counts of experimental subjects who experienced this relaxation effect.

OPSOMMING

Die Verworwe Immuniteitsgebreksindroom (VIGS) het reeds wêreldwyd pandemiese proporsies aangeneem. Sederdien voorsien dit aan die gesondheidsorgsisteem een van sy grootse uitdagings tot op datum. Tot op hede is VIGS onbehandel en lei gewoonlik tot die dood. Dit is ook 'n hoogs aansteeklike toestand wat die gemeenskap se gesondheid bedreig in terme van politiese, sosiale en ekonomiese aspekte.

Die uitdaging was en is steeds om 'n effektiewe behandelings metode ten opsigte van hierdie siekte te ontwikkel. Huidiglik is daar nog geen effektiewe behandelings metode ontwikkel nie. Dit is as gevolg van die feit dat die retrovirale agente net 'n tydelike inhibisie aan die progressie van die menslike- immuniteitsgebrek virus (HIV) veroorsak en nie 'n permanente uitwissing van die aktiwiteite van die Virus nie. In die afwisigheid van enige mediese of farmakologiese behandeling blyk dit dat gedrags ingrepe, en meer spesifiek 'n breë biopsigososiale ingreep met die kern op 'n Kognitiewe-gedrags terapeutiese model tesame met aerobiese oefening die belangrikste behandelings metode geword het. Hierdie behandelings metode blyk veral effektief te wees tydens die asimptomaties en vroeg - simptomatiese fases van VIGS (fases twee en drie van die Centre for Disease Control en fase 2-4A van die Walter Reed sisteem met CD4-T limfosiettellings van meer as 200).

Deur elektromiografiese terugvoer-gebaseerde spierontspanning (EMG) by te voeg by die bogenoemde terapeutiese modaliteite, blyk dit moontlik te wees om die spesifieke fisiologiese veranderlikes inherent aan HIV- Seropositiwiteit direk aan te spreek. Hierdie metode is 'n direkte operante intervensie om nie net die toestand te behandel nie, maar ook om die Immunsisteem funksioneering van hierdie persone te bevorder. In Suid-Afrika, word die VIGS situasie verder benadeel deur 'n groot aantaal sosiale en ekonomiese faktore in 'n samelewing wat tans baie groot en vinnige politieke en ekonomiese veranderinge ondergaan. Hierin, vererger armoede, geweld en swak mediese sorg VIGS lyers se toestand. Met hierdie faktore in gedagte blyk dit belangrik te wees om nie net die VIGS epidemie te behandel nie maar ook om die vroëe stadia daarvan aan te spreek deur die toestand sodanig te bestuur dat dit nie vererger nie.

Dit is teen hierdie agtergrond dat die huidige geindividualiseerde behandelings metode, te wete 'n kombinasie van kognitiewe-gedragsterapie, elektromiografiese terugvoer-gebaseerde spierontspanning en aerobiese oefeninge ontwikkel is. Die doel van hierdie studie was om te bepaal of die gekombineerde biopsigososiale behandelingsprogram wat ontwikkel is, suksesvol sal wees as 'n bykomstige behandelings metode vir die huidige farmakologiese behandeling, veral tydens die asimptomaties en vroeg -simptomatiese stadia van die Verworwe Immuniteitsgebreksindroom. Die intervensie het verder ten doel gehad om die sielkundige konkomitante van hierdie toestand naamlik, depressie, spanning en fisiologiese angs, as ook moegheidsvlakke te verminder en ook om die persone se aktiwiteitsvlakke en positiewe emosies te bevorder. Hierdie intervensie was toegepas op 'n groep van Suid-Afrikaanse asimptomaties en vroeg-simptomaties VIGS lyers.

Die resultate van die navorsing het getoon dat daar statisties geen beduidende tussen-groep verskille in enige van die sellulere immuun metings is nie. Klinies en statisties betekenisvolle toenames in na-toetsmetings van totale limfosiettellings was verder gevind ten opsigte van die basis metings hiervan in proefpersone. Statisties betekenisvolle tussen-groep verskille was ook gevind in terme van die sielkundige veranderlikes naamlik, fisiologiese angs, depressie, moegheid en aktiwiteits vlakke. Hierdie studie het ook gevind dat proefpersone wat laer vlakke van depressie en fisiologiese angs vertoon het, by die basislyn en na die ingreep fases, hoër CD4 -T limfosiettellings gehad het, wat aandui dat hulle 'n beter weerstand teen die menslike-immuniteitsgebrek virus en verwante toestande getoon het. Die studie het verder gevind, dat proefpersone wel laer vlakke van EMG spierontspanning aktiwiteit getoon het na die ingreep fases en op 'n 6-week opvolg stadium.

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1.1 INTRODUCTION:

The Acquired Immunodeficiency Syndrome (AIDS) has taken on pandemic proportions world wide, providing the health care system with the greatest challenge since its existence. At present, infection with the Human Immunodeficiency Virus (HIV), the virus that causes AIDS, is incurable, fatal and dangerously contagious influencing the health of the public as well as exerting profound effects on political, social and economic circumstances of the world (Barnett & Blaikie, 1992).

Early research on HIV infection and AIDS had a primarily biomedical orientation, highlighted by a single virus theory of AIDS. It was only since 1984, that a more integrated view of biological, psychological and social issues became increasingly evident in research agendas (Schlebush and Cassidy, 1995).

While biomedical research in the first decade has increased understanding of many aspects of HIV infection, and developed pharmacological agents to treat the opportunistic infections associated with HIV infection during the later stages of the AIDS disease, behavioral change still remains the only means of primary prevention against infectivity with the virus (Schlebush and Cassidy, 1995 & Lindegger & Wood, 1995).

With the development of more effective medications for the later clinical stages of HIV infection, there is now a fast-growing population of asymptomatic and early symptomatic (pre-AIDS) individuals who are having to cope with the complex and multiple psychosocial demands of a chronic life threatening disease (Kaplan, Sadock & Grebb, 1994).

Despite the positive contributions of biomedical treatments for reducing opportunistic infections associated with the later clinical stages of HIV infection, it is well known that the presently available pharmacological treatments are limited in their effect, to prolongation of the onset of clinical symptomatology and final mortality and do not constitute a cure for HIV infection or AIDS. Of all the pharmacological treatments that have been used for HIV infection, it would appear that only the drugs Azidothymidine or zidovudine (AZT), and Dideoxyinosine (ddi) in combination with saquinavir (a protease inhibitor), have had any significant impact on the progression of the disease (Goodkin, 1988 & Kaplan, Sadock & Grebb, 1994). Although these drugs have the ability to improve the immune status of HIV infected persons, they do have numerous undesirable physiological side effects, such as suppression of the bone-marrow, which can cause anemia and a drop in the white blood cell count, which in turn may increase the likelihood of opportunistic infections (Kaplan et al., 1994). Others have further noted that most antiviral drugs that are available, would be too toxic for humans if given at doses sufficient to control the HIV-viral infection (Goodkin, 1988 & Kaplan et al., 1994).

During the asymptomatic and early symptomatic stages of HIV infection which can last up to 10 years, HIV infected individuals are still capable of transmitting the virus. Even though the infected individuals are asymptomatic and seem relatively healthy, several immune parameters are already suppressed (LaPerriere, Schneiderman, Antoni & Fletcher, 1990). The suppressed immunological functioning found in very early stage HIV- infected individuals suggests that interventions specifically designed to enhance immune competence at early stages of infection may provide a means for increasing resistance to opportunistic infections. At these initial stages, the apparent sluggishness of immunological functioning may be most amenable to interventions that enhance effector functions and communication between CD4 positive cells, macrophages, Natural Killer (NK) and B cells via increases in lymphokine production (LaPerriere et al., 1990).

Furthermore, individuals who receive a seropositive diagnosis are more likely than seronegative persons to be faced with chronic and uncontrollable stress in the future as they progress through the uncertain period between diagnosis and death.
Familiar sources of social support are lost due to their own desire for social withdrawal combined with a decline in physical appearance and increased fatigue. There is also the tendency for acquaintances and significant others to avoid them as they progress in their disease. The combination of uncontrollable life stressors and diminishing social resources creates emotional burdens that may overwhelm premobid coping strategies, (e.g. active coping, being positive, making future plans). This sense of an inability to cope may bring about a loss of self esteem & self-efficacy, feelings of hopelessness, depression and anxiety (Antoni, Schneiderman, Fletcher, Goldstein, Ironson & LaPerriere, 1990). This additional anxiety may then further suppress an already compromised immune system.

The existing literature regarding the treatment of HIV-seropositivity and AIDS, would seem to indicate that a dire need exists for the development of effective adjunctive treatment methods to the presently available medico-pharmacological treatments.
Herein, biopsychosocial treatment methods, especially when used during the asymptomatic and early symptomatic stages of HIV- infection, have been shown to be somewhat more successful then the presently available retroviral agents (Antoni et al., 1990, LaPerriere et al., 1990 & Wolff, Messinis, Lamb & LaPerriere, 1996). Biopsychosocial interventions also appear, to forestall or even eliminate the onset of disease complications, such as opportunistic infections and neoplasia associated with the later clinical AIDS stages, and they appear to be doing so without any recorded side-effects (Weisse, 1992 & Wolff et al., 1996).

There is also increasing evidence that immune system functioning is altered in response to psychological stressors, and psychological distress appears to have significant deleterious effects on immunocompetency (Ader, Felten & Cohen, 1991).

In addition, Kemeny, Duran, Weiner, Taylor, Visscher & Fahey (1989) found that depressed mood was significantly correlated with immune markers of HIV progression. More specifically, total lymphocyte counts in HIV-seropositives were reduced as a result of higher depression levels. Kemeny et al., (1990) further reported that chronic depression precedes a decline in CD4-T helper cells in HIV-seropositive men.

Biobehavioral research with HIV-seropositive patients in the past has also indicated that those who employed coping strategies in dealing with their infection, had experienced less psychological distress and were able to cope better with the disease and general life events than did persons who passively accepted their HIV diagnosis. Active-positive coping was found to affect psychological states positively and correlated with lower mood disturbances (Antoni et al., 1990).

One of the most widely used behavioral therapeutic approaches with HIV-seropositive patients in the last decade, has been cognitive-behavioral therapy (Kelly, Murphy, Bahr, Kalichman, Morgan, Stevenson, Koob, Brasfield & Bernstein, 1993). Cognitive-behavioral interventions assist individuals in gaining the skills needed to manage and reduce stress, alter cognition's that exacerbate depression, and develop adaptive behavioral coping strategies to reduce excessive distress (Kelly et al., 1993) Cognitive-behavioral therapeutic approaches have further been useful in helping HIV-infected patients handle depressive symptoms and enhance perceptions of control regarding health maintenance, medication compliance, hope, and other aspects of adaptive functioning (Kelly and Murphy, 1992).

The aim of the cognitive-behavioral intervention is to facilitate cognitive restructuring, alter cognition's that facilitate depression and distress, and modify and develop coping strategies towards HIV. Coping consists of cognitive and behavioral efforts to manage specific internal or external demands that are perceived as exceeding the personal resources of an individual (Nicholson & Long, 1990), once this is achieved, individuals will be more likely to assert control over their environment and circumstances.

Cognitive behavioral interventions have further been shown to buffer post-notification depression levels, decrease levels of anxiety and emotional distress and increase NK cell activity and CD-4 T-lymphocyte cell counts in HIV-seropositive persons (Antoni et al., 1990). They have further been found to retard disease progression in asymptomatic HIV-seropositives (Antoni et al., 1990). Weisse (1992) further alleges that cognitive-behavioral therapy has been shown to be as effective as pharmacotherapy, an advantage being that it does not interfere with immunologic processes.

Studies utilizing aerobic exercise as a behavioral treatment method have also demonstrated positive effects on immunologic and physiological indices and psychological status of HIV-seropositive persons. More specifically, LaPerriere et al., (1990) reported that physical activity is related to survival time for those infected with the AIDS virus, the study further revealed that an increase in aerobic fitness is accompanied by potentially beneficial increases in T-lymphocyte subsets among HIV seropositive individuals.

Cognitive-behavioral therapeutic approaches especially when combined with aerobic activity have also been demonstrably useful with HIV-seropositive patients (Antoni et al., 1990 & Wolff et al., 1996). Research done at the Center for the Biopsychosocial Study of AIDS, at the University of Miami medical school indicated that a combined aerobic exercise and cognitive-behavioral intervention lead to improvements in the immune status of HIV-seropositive individuals, but also showed that individuals had decreased anxiety and depression levels due to improvement in mood states (Antoni et al., 1990).

In a pilot study undertaken by Wolff et al., (1996) a group of asymptomatic Human immunodeficiency Virus (HIV), and early symptomatic Acquired Immunodeficieny Syndrome (AIDS) patients, were subjected to a group-based cognitive-behavioral intervention as well as an aerobic exercise intervention and evaluated in terms of its impact on their psychosocial status as well as immunologic status (lymphocyte subsets).

It was found that the combined aerobic exercise and cognitive-behavioral group intervention produced significant improvements on levels of anger expression, depression, self-efficacy and impact of the illness. There were also some improvements in the immunologic status of the patients, and although the lymphocyte subset counts were not found to be statistically significant, they were found to be clinically significant.

Despite the positive contributions of the pilot study in reducing levels of anger expression, depression, and increasing coping self efficacy amongst asymptomatic HIV-seropositives, the pilot study lacked the efficacy to reduce the physiological component of anxiety experienced particularly by asymptomatic and early symptomatic HIV-seropositive patients. The pilot study also failed to produce statistically significant positive changes in the immunological status of HIV-seropositives, and was limited to producing clinically significant changes, which could not be generalised to larger populations of HIV-seropositives. Another limitation of the pilot study was that it was uncertain whether the acquired changes experienced by the asymptomatic HIV-seropositive patients, would remain durable over a period of time. In order to overcome the limitations of the pilot study in reducing the physiological component of anxiety, and in order to provide a direct operant intervention in enhancing immune system functioning in asymptomatic and early symptomatic HIV-seropositives, it was envisaged to use electromyographic (EMG) biofeedback-assisted relaxation training. The present health psychology\ behavioral medicine literature would seem to indicate that EMG-biofeedback assisted relaxation training as a treatment method for the physiological component of anxiety has become rapidly accepted as a therapeutic alternative to medication (Weinman, Semchuk & Gaebe, 1983 & Schwartz & associates, 1987). Various studies have also shown that EMG biofeedback-assisted relaxation training can effectively reduce tension in the frontalis muscle of the forehead, and concluded that this muscle relaxation should generalize to other muscle groups (Schwartz & Beatty, 1977 & Schwartz & associates, 1987). EMG-biofeedback is considered one of the more useful forms of feedback for training low arousal patterns, as it involves some voluntary as well as involuntary control, and thus learning accrues at a faster rate than with the training of completely involuntary responses.

Moreover, the skeletal muscle system comprises a large percentage of the entire bodily mass and therefore a change in this system can, and usually does produce changes in other systems, such as the central nervous system (CNS) and the autonomic nervous system (ANS).

The present literature would also seem to support the argument that EMG-biofeedback assisted relaxation training, is superior to either group therapy or progressive muscle relaxation in reducing physiological tension. In a study completed by Townsend, House, and Addario (1975) it was reported that EMG-biofeedback assisted relaxation training was found to be superior to group therapy, and Canter, Kondo, and Knott (1975) found EMG- biofeedback training superior to progressive muscle relaxation in reducing physiological tension levels (Gatchel & Price, 1979). Auerbach, Oleson & Solomon (1992) reported that biofeedback served as an effective adjunctive treatment method for persons suffering from AIDS-related complex and AIDS. They further reported that biofeedback assisted relaxation training was found to be more effective then guided imagery and hypnosis in treating these patients. Further literature indicates that EMG-biofeedback assisted relaxation training can also have a direct effect on immune function. Although literature investigating the effects of biofeedback training on immune function amongst asymptomatic and early symptomatic HIV-seropositives is limited, studies that have been conducted with rheumatoid arthritis patients found that a combined EMG-biofeedback and cognitive-behavioral intervention produced cellular immune enhancements and a decreased rheumatoid factor (an autoimmune antibody) (Bradley, Turner, Young, Agudelo, Anderson & McDaniel, 1985). In a study with metastatic cancer patients completed by Gruber, Hall, Hersch & Dubois (1988) it was reported that after receiving 6-weeks of biofeedback assisted relaxation training, cancer patients improved their immune response by enhancing their lymphocyte and Natural killer cell activity.

A study conducted by Peavey, Lawlis & Goven (1985) utilizing EMG biofeedback-assisted relaxation further reported significant decreases in tension and anxiety in high stress subjects and improvements in the quality of phagocytic neutrophils associated with immunity in these persons.

It would thus appear from the above literature that EMG biofeedback assisted-relaxation training produces therapeutic improvements above and beyond that which is effected by traditional therapy and progressive muscle relaxation, and that these effects could also be acheived by HIV-seropositives, especially asymptomatic and early symptomatic patients. With the present literature in mind, and with further consideration of the seriousness of the AIDS pandemic in South-Africa, as well as the absence of suitable pharmacological agents, especially for the earlier stages of HIV infection, a combined 8-week psychophysiological intervention within a biopsychosocial framework, utilizing individualised cognitive-behavioral therapy, aerobic exercise and Electromyographic-(EMG) biofeedback assisted relaxation training was developed. The aim of this intervention was to serve as a more suitable and cost effective adjunctive treatment method to the presently available pharmacological treatments, or even replace the presently available pharmacological agents in the pre-clinical HIV-stages. The development of this intervention was based and structured according to the pilot study completed by Wolff et al., (1996) and the biopsychosocial intervention completed by Antoni et al. (1990) that had been successful with asymptomatic and early symptomatic HIV-seropositive subjects. More specifically, by replacing the group-based cognitive-behavioral intervention of the pilot study with individualised cognitive-behavioral therapy and EMG-biofeedback assisted relaxation training, the emphasis of this intervention would be not so much on anger-expression, as was the aim of the group sessions of the pilot study, but rather on physiological tension-reduction in order to alleviate the higher levels of anxiety and physiological tension associated with the asymptomatic and early symptomatic stages of HIV- infection.

The rationale for using EMG-biofeedback assisted relaxation training was based on the idea that if the autonomically mediated physiological arousal associated with anxiety experienced by asymptomatic HIV-seropositives can be reduced or controlled, the motor and behavioral manifestations as well as subjective reports may subsequently decrease (Rice & Blanchard, 1982 & Schwartz & associates, 1987). The idea was that successful EMG-feedback assisted relaxation training could help the HIV infected person call upon relaxation skills to help counteract the arousal and physiological reactions to stress and tension while enhancing the individual's belief of self mastery and competence (Weinman, Semchuk, Gaebe & Mathew, 1983 & Schwartz & associates, 1987).

It was also assumed that once the HIV-seropositive patients were able to recognize and voluntarily control their own physiological tension levels, they could transfer this control to everyday life situations outside the clinic. It was further hypothesised, that by combining a more purely physiological treatment method in the form of aerobic activity, with a psychological treatment method in the form of Cognitive-behavioral therapy and a psychophysiological treatment modality in the form of EMG-biofeedback assisted relaxation training, the effects should be both stress-attenuating and immunomodulatory for HIV-seropositive patients. It is especially during the asymptomatic and early symptomatic stages of HIV-infection, where the apparent sluggishness of immunological functioning may be most amenable to interventions that enhance effector functions and communication between CD4 T-lymphocytes, CD8 T-lymphocytes, macrophages and B cells via increases in lymphokine production. By combining the therapeutic modalities mentioned above, it would also appear possible to produce significant positive changes in those psychological states more specifically related to psychophysiological and \or physical functioning. These would include, vigor-activity and fatigue-inertia levels. Fatigue is associated with HIV from the early-stage acute infections through late-stage AIDS.

It increases in severity with disease progression and impairs the individuals ability to perform even normal daily activities (Eller, 1995). It has also been positively correlated with immunosuppression and therefore disease progression in HIV-seropositives (LaPerriere et al., 1990 & Eller, 1995).

Significant positive changes in the fatigue levels of HIV-seropositives are expected to correlate with increases in the vigor-activity levels of these persons, therefore bringing about a more active approach to the treatment of HIV- infection. It is further expected that a decrease in the overall fatigue levels of HIV-seropositives, should correlate positively with the immunosuppression experienced by these persons and therefore cause a delay in the onset of symptoms associated with the later clinical AIDS stages.

1.2 DEFINITION OF ACQUIRED IMMUNODEFICIENCY SYNDROME (AIDS)

The definition of AIDS has changed over time as researchers have learned more about the disease. At present, The Centers for Disease Control and Prevention (CDC), stipulates that an individual may be positively diagnosed for AIDS, when the patient has a reliably diagnosed disease that points to an underlying deficiency in the immune system which is not due to immunosuppressive drugs of any other immunosuppressive disease, and has been tested positively for the HIV antibody (Ijssenlmuiden, Steinberg, Padayachee, Schob, Strauss, Buxh, Davies, De Beer, Gear & Hurwitz, 1988, Hulley & Hurst in Mays, Albee & Schneider, 1989 & Kaplan et al., 1994).

However, in countries where sophisticated medical and clinical diagnostic tests are not available, AIDS may be classified by at least two major symptoms i.e. weight loss, greater than 10% of the persons weight and chronic diarrhea; and at least one other major symptom, for example oropharyngeal or candidiasis, provided that no other causes for immunosuppression are present (Ijssenlmuiden et al., 1988 & Kaplan et al., 1994).

1.3 HUMAN IMMUNODEFICIENCY VIRUS - ROUTES OF TRANSMISSION

Analysis of early AIDS surveillance data and epidemiologic investigation of cases demonstrated that HIV transmission was associated with membership in one of several major risk groups, namely homosexual and bisexual men, intravenous drug abusers, hemophiliacs, transfusion recipients, children of infected mothers, and sexually active heterosexuals (Centers for Disease Control, CDC, 1987c).

Spread is now known to occur from person to person during sexual contact, from mother to child during pregnancy or the perinatal period, and through parenteral exposure to blood or blood products. There is also evidence that HIV may be transmitted through breast milk, during breast feeding. Rarely however, has HIV been transmitted after organ transplantation or artificial insemination (CDC, 1987d).
The risk of transmission of HIV infection to transfusion recipients and hemophiliacs has virtually been eliminated. This success is due to a combination of HIV antibody screening of all blood donations, requests that individuals in high-risk groups not donate blood (CDC, 1985) and improved procedures for heat treatment of clotting factors (CDC, 1988c).

All of the other risk groups remain at relatively higher risk for transmission. In developing countries however, blood transfusions still present a substantial risk because screening of blood is not universal. Other possible routes of transmission have not been implicated. Although HIV has been isolated from a number of body fluids, including blood, vaginal secretions, semen, breast milk, saliva, urine and tears (Glasner and Kaslow, 1990) there is no epidemiologic evidence that transmission has occurred from contact with the latter three. Moreover, the frequency of isolation of the virus from cell-free fluids, such as saliva, urine and tears of infected persons, is substantially lower than from blood (Glasner and Kaslow, 1990).

In numerous studies of household members of HIV-infected patients in both the United States and Europe, transmission has not occurred through casual contact (Glasner and Kaslow, 1990). Laboratory and epidemiological studies have also shown no evidence of transmission of HIV through insects (Castro, Lieb, Jaffe, Narkunas, Calisher, Bush & Witte, 1988).

1.3.1 SPECIFIC RISK FACTORS FOR TRANSMISSION

For certain risk groups there is more evidence that specific factors increase the risk of transmission. In Intravenous drug abusers, transmission has been shown to be associated both with sharing of injection equipment and with a high frequency of injection of drugs independent of sharing of equipment (Glasner and Kaslow, 1990).

In homosexual men, receptive anal intercourse and rectal trauma (Chmiel, Detels, Kaslow, Van Raden, Kingsley, Brookmeyer & The Multicenter AIDS Cohort study group, 1987) have shown the strongest association. In one prospective study, insertive anal intercourse posed a small risk and oral receptive intercourse was not shown to be associated with the development of antibodies to HIV seroconversion. Also, the frequency of partners with whom an individual practiced receptive anal intercourse increased risk (Glasner and Kaslow, 1990).

Analysis of risk factors for heterosexual transmission has been confined to studies of prevalent infections in small numbers of patients. In one study of hemophiliacs and their partners, an association was found between the degree of depletion of T-helper lymphocytes in the infected hemophiliac and transmission of the virus. If confirmed, these data would suggest that the ability to transmit or infect increases late in the course of infection, as immune deficiency develops (Glasner and Kaslow, 1990).

Sexually transmitted diseases (STDs), have been postulated to increase transmission of HIV infection by promoting penetration through skin ulceration or by enhancing susceptibility due to stimulation of the immune system.

Several studies have shown associations between a history of STDs and prevalent HIV infection, however, these associations do not unequivocally establish the STD facilitated HIV transmission (Glasner and Kaslow, 1990).

Prospective studies permit a fuller accounting for other factors, such as the number of sexual partners and the relation of the presence of a specific STD to the time when HIV infection is acquired. In a prospective study of African prostitutes, factors shown to be associated with increased frequency of acquiring HIV infection include genital ulcer disease, Chlamydia trachomatis infection, and oral contraceptive use (Cameron, Plummer, Simonsen, Ndinya-Achola, D Costa & Piot, 1987).

There is also evidence that men who acquired genital ulcer disease from prostitutes likely to be infected with HIV had a higher chance of acquiring HIV infection at the same encounter than did men who acquired other sexually transmitted diseases from prostitutes (Cameron et al., 1987). This is consistent with increased transmissibility of HIV infection, due to genital ulcer disease in the female. Although it is difficult to study the male-to-female prevalence ratio, prevalence rates in partners of heterosexuals suggest that transmission from men to women occurs more easily than from women to men.

If this difference is real, it may be explained by exposure to the greater area of mucosal surface in the female genital tract. On the other hand, higher rates of infections producing genital ulcers, might explain the nearly equal male-to-female ratio of transmission reported in Africa. Other unknown factors may affect the relative contagiousness or susceptibility of an individual. Transmissibility from an infected person may be determined by characteristics of that person or of the virus, or both.

In a study of monogamous partners of individuals with transfusion-associated infections, no statistical relation could be found between the number of sexual contacts and the frequency of viral transmission. Most partners did not acquire infection, despite repeated sexual contacts, whereas in certain couples, transmission occurred after only a few contacts (Glasner and Kaslow, 1990).

An important protective factor for transmission is the use of condoms. In laboratory studies, latex condoms have proved impermeable to HIV (Conant, Hardy, Sernatigner, Spicer, & Levy, 1986). Although condoms are undoubtedly highly effective, their ability to prevent all sexual transmission in humans is theoretically limited by potential incorrect usage, breakage, leakage, and by uncommon transmission through other routes (oral sex or deep kissing). In one study of 24 uninfected partners of AIDS patients followed for 2 years, 1 out of 10 partners using condoms and 12 out of 14 partners not using them became infected. In a study conducted by Detels et al., (1988) in Glasner and Kaslow, (1990) homosexual men at risk for infection were followed for 2 years, during which time condom use was shown to reduce infection substantially, but not to prevent it completely. Laboratory studies have also shown that spermicides inactivate HIV and kill lymphocytes infected with the virus (Glasner and Kaslow, 1990).

1.3.2 PATTERNS OF TRANSMISSION OF THE HUMAN IMMUNODEFICIENCY VIRUS.

Patterns of transmission vary considerably around the world. Patterns of transmission in the United States, as reflected in the distribution of AIDS cases, are similar to those in Canada, Europe, Australia, New Zealand and Parts of Latin America.

Spread is predominantly through homosexual contact and among Intravenous drug abusers. In contrast, in Africa including South Africa and Haiti, heterosexual transmission appears to predominate. As expected in the developing world, where health-care resources are meager, blood transfusions and injections with unsterilized needles probably account for a larger proportion of infections (Glasner & Kaslow, 1990). Moreover, because large numbers of young women in these countries are infected, perinatal transmission is a relatively large problem as well. In some countries where the prevalence of AIDS is high, such as in Brazil and the Dominican Republic, the pattern of spread seems to fall somewhere between these extremes. There the adult male-to-female ratio of cases is not as high as the 11:1 ratio seen in the United States or as close to the 1:1 ratio seen in Africa and Haiti (CDC, 1989 and Glasner & Kaslow, 1990).

1.4 EPIDEMIOLOGY OF HIV INFECTION AND AIDS

1.4.1 THE AIDS PANDEMIC IN SOUTH AFRICA

Considerable literature exists on the management and the care of AIDS sufferers in industrialized countries (Schopper & Walley, 1992). However, the clinical expression of the disease, the opportunistic infections, epidemiological profiles and risk groups vary across regions (Ijsselmuiden, Steinberg, Padayachee, Schob, Strauss, Buxh, Davies, DeBeer, Gear & Hurwitz, 1988).

South Africa possesses a unique socio-political structure and is confronted by unique problems as the pandemic spreads in a society expressing rapid political change against a background of apartheid (Steere, 1984 & Barnett & Blaikie, 1992). The situation is further compounded by a number of social and economic factors intrinsic to the South African society. Crewe, (1992, p. 2) alleges that "the entire subject is shaped by a cultural agenda that is as medically misinformed as it is socially misleading and politically motivated". Although a new government has taken over, negative perceptions and stereotypes surrounding AIDS sufferers are still existent. These perceptions are further compounded by the ever existing racial barriers in a society which will require many more years, money and changes to overcome this barrier. The future of AIDS sufferers will therefore be influenced by the various social, economic and political conditions effecting each group . Individuals who fall into high risk categories are further exposed to a hazardous environment which in turn confounds the difficulties associated with the contracting of the AIDS virus, like long periods of social unrest and economic disruption (Barnett & Blaikie, 1992) and the lack of adequate health care resources (Dommisse, 1987).

1.4.1.1 DEMOGRAPHICS

Due to the seriousness of the AIDS pandemic in South Africa, forecasts of the course of the disease have been demanded from decision-makers in the health sector, industry, business community and the general public (Schall, 1990).

In order to forecast the extent of the pandemic, a detailed modeling of the illness and it's underlying population as well as knowledge concerning the demographic, social and epidemiological factors is required. The first AIDS cases in South Africa were diagnosed in 1982. Even though AIDS has never been declared a notifiable condition, doctors were requested to voluntarily report all newly diagnosed AIDS cases to the South African Institute for Medical Research up to the end of 1992, to the regional offices of the Department of Health since the beginning of 1993.

Based on scenario planning, demographers speculate that by the year 2000, 5.3 million people in South Africa will have AIDS (Smerczak, 1991). The number of AIDS cases in South Africa tends to double every 8.5 months, thus the expected personal, social, and economic consequences of this pandemic are expected to be enormous. The cumulative rate of AIDS patients per 100 000 of the population varies between 5.24 in the Northern Transvaal and 28.16 in KwaZulu/Natal. Reporting response varies considerably between the provinces. The number of AIDS patients reported during 1993 and 1994 as a percentage of the total number reported since the start of the pandemic, ranges between 26% and 94%. Although the age distributions per province differ, the bulk of AIDS cases are between 20 and 39 years old. As on 17 July, 1995, a total of 3779 male adult cases were reported, 3663 female adults, 868 Mother to Child and 60 unknown. This brings the total number to 8370 reported cases, of which, 1502 deaths occurred (Epidemiological Comments, June 1995).

The distribution of AIDS cases reported per region as on 17 July 1995, was as follows: Eastern Cape 536, Western Cape 399, Northern Cape 163, KwaZulu/Natal 4130, Free State 771, Gauteng 986, Eastern Tvl 439, North West 471, Northern Tvl 475.

AIDS cases by mode of transmission is shown in the following table, (Table 1.1) as extracted from Epidemiological Comments 22 (6), June, (1995).

TABLE 1.1:

AIDS CASES BY MODE OF TRANSMISSION

	ASIAN M / F	BLACK M / F / UNK	COLOURED M / F / UNK	WHITE M / F / UNK	UNKNOWN	TOTAL
HOMO/BI SEXUAL	4 / -	93 / - / -	31/ -/ -	404/ -/ -	3	535
HETERO SEXUAL	6 / 3	2209 / 2709 / 34	84 / 113/ -	33 / 15 / 1	21	5228
HAEMO PHILIAC	- / -	4 / 1 / -	1 / - / -	18 / - / -	-	24
TRANS FUSION	- / -	8 / 2 / -	1 / 1 / -	12 / 5 / 1	-	30
IVDU	- / -	1 / - / -	- / - / -	2 / - / -	-	3
MOTHER TO CHILD	- / -	442 / 397 /10	10 / 5 / -	-/ - /-	4	868
UNKNOWN	1 / 2	826 / 770 / / 13	14 / 25/ 1	11 / 1 / -	18	1682
TOTAL	11 / 5	3583/3879 /57	141 / 144 / 1	480 / 21 / 2	46	8370

M= Male , F= Female ,UNK=Unknown .

1.4.2 POLITICAL POLICIES ON AIDS IN THE NEW SOUTH AFRICA

Despite the fact that most political parties in South Africa view AIDS as a very important issue for the new government, few have written policies on HIV /AIDS.

More specifically, the African National Democratic Party (ACDP), African National Congress (ANC), Democratic Party (DP) and the National Party (NP) said they viewed AIDS as a very important issue for the new government.

The Conservative Party (CP) said that it did not view AIDS as a very important issue for the new government but sees it as "just important ".

The Pan Africanist Congress (PAC) and Inkatha Freedom Party (IFP) have not as yet elicited their positions on this matter (AIDS Analysis Africa, South African Edition 4 (6) April/ May, 1994).

1.4.2.1 HEALTH CARE FOR HIV POSITIVE PEOPLE IN SOUTH AFRICA

The ANC guarantees compassionate care for HIV infected people. Acceptance that AIDS is a chronic illness requiring on-going care to maintain the quality of life for those infected is essential according to the ANC. It also provides for the establishment of STD and HIV counseling and support services in all community health centers. The NP advocates preventative measures such as educating people about the disease through the regional health offices of the Health Department. It also provides for the treatment of those already infected by the disease by inter alia, subsidizing non-governmental organizations (NGOs) to encourage them to be involved. The DP, despite having no written policy yet, submits that HIV positive people deserve every consideration and help, both morally and medically. "There is going to be a major need for families to participate in nursing their people while the state must be prepared to involve itself financially" (Aids Analysis Africa, Southern Africa Edition Apr/May, 1994).

1.4.2.2 EMPLOYMENT AND EDUCATION OPPORTUNITIES FOR HIV-POSITIVE PEOPLE IN SOUTH AFRICA

The ANC argues that HIV should not be grounds for refusing to employ any person and that HIV or AIDS do not, by themselves, justify termination of employment or demotion, transfer or discrimination in employment. The mere fact that an employee is HIV positive or has AIDS does not have to be disclosed to the employer. The NP has a policy of non-discrimination on the basis of being HIV positive or having full-blown AIDS. HIV positive people should have equal access to employment opportunities (Aids Analysis Africa, Southern Africa Edition Apr/May, 1994).

1.5. THE AIDS PANDEMIC IN NEIGHBOURING COUNTRIES

1.5.1 BOTSWANA

Botswana with an estimated population of 1 352 000 in 1993 is ranked by the World Bank as an upper-middle-income country. They have one of the fastest growing economies in the world. Economic prosperity however, did not limit the effect of the HIV/AIDS pandemic. Up to 31 December 1993, Botswana had reported 1 415 AIDS cases to the World Health Organisation (WHO), which gives a cumulative rate of 104,66/100 000. A sentinel survey at four sites, covering antenatal clinic attendees, men presenting with STDs and TB patients was carried out between February and April 1992 (Epidemiological Comments, November 1994). Based on the results, the AIDS/STS unit estimated that 9% of the sexually active people (equivalent to some 60 000 people) were infected. One year later the survey was repeated involving five additional sites to cover rural areas as well. In antenatal clinic attendees, one out of three women in Francistown was infected, one out of five in Gaborone the capital, and between one out of ten in the rest of Botswana. The peak prevalence for women is among 20-24 year olds and in the male STD clinic attendees among 25-29 year olds (Epidemiological Comments, November 1994).

1.5.2 LESOTHO

Lesotho has an estimate 1 882 000 inhabitants. As on 10 December 1993, Lesotho reported 479 cumulative AIDS cases to the World Health Organization.
In 1991 an HIV sentinel surveillance system was implemented by the Ministry of Health and Social Welfare of Lesotho. Five sentinel sites were identified in which annually a specified number of consecutive antenatal-and STD clinic attendees were screened for HIV. In 1993 HIV prevalence in the antenatal clinic attendees varied between 3 and 11% and in STD clinic attendees between 11 and 21%. All the chosen sentinel sites are in the lowlands area. There is still a need for surveillance information in the Highlands area (Epidemiological Comments, November 1994).

1.5.3 SWAZILAND

Swaziland with an estimated 1993 population of 814 000 diagnosed their first AIDS patient in 1987, five years after South Africa diagnosed their first AIDS cases.
AIDS was designated a notifiable condition in Swaziland which means that legally, all cases should be reported to health authorities. On 13 May, 1994 the Swaziland Times reported that 445 AIDS cases had already been notified to the health authorities. About one third of the AIDS patients were between 20 and 29 years. Females were affected at a younger age than males. Sentinel studies in antenatal clinics were carried out in October/November 1992 and again during the same period in 1993. In 1992, 3,9% of the antenatal clinic attendees were HIV positive. One year later HIV prevalence in this group increased to 21,9%. Based on these results it was estimated that 18,42% of the adult population was HIV positive (Epidemiological Comments, November 1994).

1.5.4 ZIMBABWE

As on 31 December 1993, 27 905 AIDS cases had been reported in Zimbabwe, a country with an estimated population of 10 898 000. The effect is already felt by all Zimbabweans. The Burger of 21 March 1994 reported, "that almost all Zimbabweans know somebody who is either dying of AIDS or has already died".
Hospital wards are full of AIDS patients while many patients are sent home after treatment of symptoms. AIDS is the leading single cause of death in children under five" (Epidemiological Comments, November 1994).
"Health officials said estimates put the number of HIV - infected people at 800 000 and by the end of 1995, the number of full-blown AIDS cases was likely to reach 120 000" (Epidemiological Comments, November 1994).

1.6 GLOBAL DISTRIBUTION OF THE HUMAN IMMUNODEFICIENCY VIRUS

Estimating the true worldwide extent of HIV infection is difficult. Analysis of data on AIDS patients grossly underestimates the distribution and frequency of infection. Routine testing of large populations is expensive and problematic for a variety of legal, ethical and public health reasons. Furthermore, because of the uneven distribution of the infection in the populations and the lack of knowledge of total number of individuals in certain high-risk groups, the total number of infected individuals cannot be accurately reflected. In spite of these limitations, the best available comparative estimates of relative infection rates throughout the world come from reporting of AIDS cases to the World Health Organization,(WHO).

As of the 30th June, 1994 , 985119 AIDS cases have been reported to the world health organization (WHO) since the onset of the pandemic. Based on available data on HIV infections and taking into account reporting delays, incomplete reporting and under diagnosis, the WHO estimates the true number of AIDS cases since the pandemic started to be around 4 million (Epidemiological Comments, November 1994).

Although the United States of America has reported 42% of the AIDS cases, it is estimated that they account for 10% of the AIDS cases occurring world wide.
It is estimated that more than two thirds of the cases have probably occurred in Africa, and that world wide more than 16 million adults and 1 million children have been infected with the HIV virus since the start of the pandemic.
Sub-Saharan Africa accounts for approximately 10 million infections, and eighty to ninety percent of the HIV infected children are probably from Sub-Saharan Africa, (Epidemiological Comments, November 1994). An interesting feature of the above figures is that in 1985 women made up 7% of the total number of infections. In 1989, this figure had risen to 11% of the total infected population and by the end of 1995, these figures are expected to double (Lachman, 1991).

Of the 985 119 AIDS cases reported worldwide 331 376 are from Africa, 111 870 are from the Americas, 411 907 from the United states of America, 8968 in Asia, 115 668 in Europe and 5330 in Oceania (Epidemiological Comments, November 1994).

Recently the World Health Organization (WHO) applied a Delphi method, (The Delphi method attempts to improve the quality of judgment needed in relatively uncertain situations) to project HIV prevalence and AIDS incidence for the period 1988 to mid-2000. The cumulative number of adults AIDS cases projected by the year 2000 is between 5 and 6 million. Even when asked to take into account a concerted global effort for prevention of the disease, Delphi participants expected that less than half of the projected future AIDS cases would be preventable. For the year 1988 a global total of 90 000 AIDS cases was estimated . Even with a continued global effort, the annual incidence of AIDS cases was projected to be about 450.000 in 1995 and 600,000 in the year 2000 (Schopper & Walley, 1992).

1.7 THE CARE OF AIDS PATIENTS IN DEVELOPING COUNTRIES

As an ever increasing number of HIV infected persons develop AIDS, treating the manifestations associated with HIV infection has become a new challenge to health sectors in developing countries. In most of these countries the health sector has suffered from limited budgets and lack of trained personnel to implement primary health care strategies, and adding to this the additional HIV/AIDS patient load, will impose an even greater burden on these limited health resources (Schopper and Walley, 1992)

Diagnosis of AIDS in developing countries is based on the World Health Organization, (WHO) diagnostic criteria or on the Center for Disease Control, (CDC) criteria which includes confirmatory HIV testing. In those African countries where prevalence of the disease is already high, and where testing for HIV is not available for routine use due to cost, diagnosis can be made with confidence using solely clinical criteria.

Diagnosis of some opportunistic infections can be ascertained by simple microscopic examination. However, other opportunistic infections can only be detected using more difficult and expensive procedures, such as biochemical tests, cultures, serologic tests, biopsies, endoscopies and X-ray examinations, including CT-scans. The cost-effectiveness, in developing countries, of these procedures in diagnosing AIDS and related infections should be studied. In addition, their relevance with regard to therapeutic choices should be examined, and diagnostic guidelines should be established and evaluated (Schopper and Walley, 1992).

Antiretroviral treatment:

The use of AZT (Zidovudine) and 3TC in combination with saquanavir, in developed countries has been shown to prolong life for several months. However, limited accessibility, the need for elaborate patient monitoring due to drug toxicity and particularly high cost limit the usefulness of antiretroviral treatment in these countries (Schopper and Walley, 1992)

Treatment of opportunistic infections:

Many health workers, even in high prevalence countries, have not received training in the clinical management of AIDS. The WHO is developing generic clinical management guidelines for adults and children, for self-instruction and training of clinicians (WHO, 1990). The guidelines are symptom-based and use flow-chart algorithms which are segmented into three levels, based on the availability of diagnostic facilities. These guidelines are adaptable to country-specific situations. More studies are however, needed to set priorities for treatment of opportunistic infections, taking into account survival time, quality of survival, impact on the general population and the availability of resources. Where clinical guidelines exist and are being implemented, a formal evaluation of these guidelines would be valuable.

1.8 MEDICAL MICROBIOLOGY AND IMMUNOLOGY OF THE HUMAN IMMUNODEFICIENCY VIRUS -INFECTION AND AIDS.

1.8.1 THE IMMUNE SYSTEM.

The main function of the immune system is to prevent or limit infections by microorganisms such as bacteria, viruses, fungi, and parasites (Levinson & Jawetz, 1994). Protection is provided primarily by the cell-mediated and antibody-mediated (humoral) arms of the immune system. The cell-mediated arm consists primarily of T lymphocytes (e.g. helper T cells and cytotoxic T cells) whereas the antibody-mediated arm consists of B lymphocytes and plasma cells. The main function of antibodies are to neutralize toxins and viruses and to opsonize bacteria, making them easier to phagocytize. Cell-mediated immunity on the other hand, is directed primarily against organisms such as fungi, parasites, and certain intracellular bacteria, it is also involved in the killing of virus-infected cells and tumor cells. The combined effects of certain cells (e.g. T cells, B cells, macrophages and neutrophils) and certain proteins (e.g. antibodies and complement) produce an inflammatory response, one of the body's main defense mechanisms against disease (Jensen & Wright, 1989 and Levinson & Jawetz, 1994).

1.8.1.1 IMMUNE-CELLS AND THEIR FUNCTIONS

The capability of responding to immunologic stimuli rests mainly with lymphoid cells. During embryonic development, blood cell precursors originate mainly in the fetal liver and yolk sac.(In post-natal life, the stem cells reside in the bone marrow).
Stem cells differentiate into cells of the erythroid, myeloid, or lymphoid series. The latter evolve into 2 main lymphocyte populations: T-cells and B-cells, at a ratio of 3:1.
Within the thymus, T-cell progenitors differentiate under the influence of thymic hormones into T-cell subpopulations.

T-cells are further subdivided into 2 major categories on the basis of whether they have CD4 or CD8 proteins on their surface. Mature T-cells have either CD4 or CD8 proteins on their surface, but not both (Jensen & Wright, 1989 and Levinson & Jawetz, 1994).

1.8.1.2 FUNCTIONS OF CD4 AND CD8 T-CELLS

T-cells perform several important functions which can be divided into 2 main categories, namely, regulatory and effector. The regulatory functions are mediated primarily by helper CD4-positive cells, which produce interleukins. For example helper T cells make interleukin-4 (IL-4) and IL-5, which help B cells produce antibodies.

The effector functions are carried out primarily by cytotoxic CD8-positive T cells, which kill virus-infected cells, tumor cells, and allografts. CD4 cells also have an effector function, since they mediate delayed hypersensitivity against intracellular organisms such as Mycobacterium tuberculosis (Levinson & Jawetz, 1994 and Stites, 1994).
The profound immune suppression that characterizes later stages of HIV infection is due to the progressive functional impairment and selective loss of CD4+ T lymphocytes (Levy, 1992, Roitt, 1994 and Stites, 1994).

The CD4 T lymphocyte count is an indicator of disease progression and correlates highly with symptom severity. It is the most frequently used marker for disease progression and response to clinical interventions (Clement & Hollander, 1992).

The CD8 T lymphocyte is responsible for antigen-specific clearance of virally infected cells and tumor cells. The cytolytic function of these cells is stimulated by CD4 lymphocyte cytokines. The CD8 lymphocyte is an important marker of immunity in persons with HIV in its relative proportion to the CD4 T-cell. The CD4:CD8 T-lymphocyte ratio is related to severity of symptoms, including fatigue and depression and is another marker for HIV disease progression (Clement & Hollander, 1992 & Saag, 1992). More specifically, the characteristic immunodeficiency associated with AIDS is caused by the destruction of the T-helper\ inducer cells by the virus.

The helper : suppresser (CD4:CD8) ratio becomes reversed as the number of suppresser (CD8) cells increase. This results in deficiencies in CD4 cells to signal the B-cells to respond by producing an antibody. Instead, immunoglobulins are secreted which are undirected and non-specific, resulting in a failure to provide any defense against toxins, bacteria or virus (Pudifin, Duursma & Prior, 1990).

CD4 T - lymphocytes perform the following specific helper and effector functions:

1) They help B cells develop into antibody-producing plasma cells.
2) They help CD8 cells to become activated cytotoxic T cells.
3) They effect delayed hypersensitivity.

These functions are performed by 2 subpopulations of CD4 cells. Th-1 cells mediate delayed hypersensitivity and produce primarily IL-2 and gamma interferon, whereas Th-2 cells perform the B cell helper function and produce primarily IL-4 and IL-5.
CD4 cells make up about 65% of peripheral T cells and predominate in the thymic medulla, tonsils and blood (Levinson& Jawetz, 1994).

More specifically, CD8 T- lymphocytes perform both cytotoxic and suppressor functions:

1) They are cytotoxic for virus-infected, tumor, and allograft cells.
2) They suppress immunoglobulin production by B cells.
3) They suppress delayed hypersensitivity reactions and cellular immunity.

CD8 cells predominate in human bone marrow and gut lymphoid tissue and constitute about 35% of peripheral T cells (Levinson & Jawetz, 1994 & Roitt, 1994).

1.8.2 HUMAN IMMUNODEFICIENCY VIRUS (HIV-1 and HIV-2).

Two subtypes of Human Immunodeficiency Virus, HIV-1 and HIV-2, have now been identified (Berkelman, Heyward, Stehr-Green & Curran, 1989). HIV-1 predominates in the United States and Western Europe. HIV-2, is found primarily in Western Africa. Structurally, HIV-1 and HIV-2 have many similarities.

They are lipid enveloped and their genomes consist of single-stranded RNA containing three major structural genes, gag, pol, and env. The gag region codes for the major nucleocapsid (core) proteins, the pol region for three enzymes (endonuclease, protease and reverse transcriptase), and the env region codes for the 41,000 molecular weight transmembrane glycoprotein (gp41). Gp41 anchors a 120,000 molecular weight surface glycoprotein (gp120) to the lipid membrane of the virus. The two subtypes of HIV are genetically distinct, predominantly in the env region, which results in substantial differences in the envelope glycoproteins. These differences result in distinct immune responses to infection that require specific HIV-1 and HIV-2 immunoassays or Western blot procedures for serologic diagnosis. Additional virus-encoded regulatory proteins, tat, rev, nef, and vif have been described. Two of these, tat and rev, appear to enhance virus replication, whereas the nef region appears to down regulate virus replication. Vif may be involved in regulating final maturation of the virus at the cell membrane (Kessler and Harris, 1992).

1.8.3 PROPERTIES OF THE HUMAN IMMUNODEFICIENCY VIRUS (HIV).

The Human Immunodeficiency Virus (HIV), is the cause of Acquired Immunodeficiency Syndrome (AIDS). HIV is one of the human T cell lymphotrophic retroviruses, (human T cell leukemia virus (HTLV) type I and II are others). HIV preferentially infects and kills helper (CD4) T lymphocytes, resulting in the loss of cell-mediated immunity and a high probability that the host will develop opportunistic infections. Other cells, for e.g. macrophages and monocytes, that have CD4 proteins on their surfaces can also be infected. HIV belongs to the lentivirus subgroup of retroviruses, which cause "slow" infections with long incubation periods. HIV has a bar-shaped (type D) nucleoid surrounded by an envelope, containing virus-specific glycoproteins. The genome of HIV consists of two identical molecules of single-stranded, positive-polarity RNA.

The HIV genome is the most complex of the known retroviruses. In addition to the 3 typical retroviral genes, gag, pol and env, which encode the structural proteins, the genome RNA has at least 5 other genes, several of which are regulatory genes (Jensen & Wright, 1989 and Levinson & Jawetz , 1994). The gag gene encodes the internal "core" proteins, the most important of which is an antigen used in serologic tests. The pol gene encodes several proteins including the virion "reverse transcriptase," which synthesizes DNA by using the genome RNA as a template, an integrase that integrates the viral DNA into the cellular DNA, and a protease that cleaves the various viral precursor proteins. The env gene encodes gp160, a precursor glycoprotein that is cleaved to form the 2 envelope (surface) glycoproteins, gp120 and gp41. Two of these proteins are located within the nucleocapsid of the virion: reverse transcriptase and integrase. Reverse transcriptase is the RNA-dependent DNA polymerase that is the source of the family name, retroviruses. This enzyme transcribes the RNA genome into the proviral DNA. Reverse transcriptase is a bifunctional enzyme, it also has ribonuclease H activity. Ribonuclease H degrades RNA when it is in the form of an RNA-DNA hybrid molecule. The degration of the viral RNA genome is an essential step in the synthesis of the double-stranded proviral DNA. Integrase, the other important enzyme within the virion, mediates the integration of the proviral DNA into the host cell DNA (Jensen & Wright, 1989 and Levinson & Jawetz, 1994). The gp120 and gp 41 are the type-specific envelope glycoproteins. The gp120 glycoprotein protrudes from the surface and interacts with the CD4 receptor on the cell surface. The gp41 glycoprotein is embedded in the envelope and mediates the fusion of the viral envelope with the cell membrane at the time of infection. The gene that encodes gp120 mutates rapidly, resulting in many antigenic variants. The most immunogenic region of gp120 is called the V3 loop, it is one of the sites that varies antigenically to a significant degree. Antibody against gp120 neutralizes the infectivity of HIV, but the tapid appearance of gp120 variants make production of an effective vaccine difficult.

The high mutation rate may be due to lack of an editing function in the reverse transcriptase. The group-specific antigen, pg24, is located in the core and is not known to vary. Antibodies against p24 do not neutralize HIV infectivity, but serve as important serologic markers of infection (Jensen & Wright, 1989 and Levinson & Jawetz, 1994).

The natural host range of HIV is limited to humans, although certain primates can be infected in the laboratory. HIV is not an endogenous virus of humans, ie. no HIV sequences are found in normal human cell DNA. The origin of HIV and how it entered the human population remains uncertain. There has been speculation that monkeys or other primates were the source, but the issue is unresolved. Viruses similar to HIV have been isolated, for example: Simian Immunodeficiency Virus (SIV) was isolated from monkeys with an AIDS-like illness. Antibodies in some African women cross-react with SIV. The proteins of SIV resemble those of HIV-2 more closely than they resemble those of the original HIV isolates, and HTLV-IV which infects T cells but does not kill them and is not associated with any disease (Villee, Solomon, Martin, Martin, Berg & Davis, 1985, Jensen & Wright, 1989 and Levinson & Jawetz ,1994)

1.8.4 THE HIV REPLICATIVE CYCLE

The details of the replicative cycle of the HIV are incomplete, but it is thought to follow the typical retroviral cycle. The initial step in the entry of HIV into the cell is the binding of the virion gp120 envelope proteins to the CD4 protein on the cell surface. The virion gp41 protein then mediates fusion of the viral envelope with the cell membrane and the virion enters the cell. After uncoating, the virion RNA-dependent DNA polymerase transcribes the genome RNA into double-stranded DNA, which integrates into the host cell DNA. The viral DNA can integrate at different sites in the host cell DNA, and multiple copies of viral DNA can integrate.

Integration is mediated by a virus-encoded endonuclease (integrase). Viral mRNA is transcribed from the proviral DNA by host cell RNA polymerase and translated into several large polyproteins, which are then cleaved by the virus-encoded protease to form the virion structural proteins, namely the reverse transcriptase, the core proteins, and the 2 envelope glycoproteins. The virions assemble in the cytoplasm and are released from the cell by budding. Much of the virus remains cell-associated and may be difficult to neutralize with antibody (Jensen & Wright, 1989 and Levinson & Jawetz , 1994).

1.8.5 PATHOGENESIS AND IMMUNITY

HIV infects helper CD4-T cells, and kills them, resulting in suppression of cell-mediated immunity. This predisposes the host to various opportunistic infections and certain cancers such as Kaposi's sarcoma and lymphoma. However, viral genes are not found in these cancer cells, so HIV does not directly cause these tumors. HIV also infects brain monocytes and macrophages, producing multinucleated giant cells and significant central nervous symptoms. The fusion of HIV-infected cells in the brain and elsewhere mediated by gp 41 is one of the main pathologic findings. The cells recruited into the syncytia ultimately die. The death of HIV-infected cells may also be the result of immunologic attack by cytotoxic CD8 lymphocytes or antibody. Effectiveness of the cytotoxic T cells may be limited by the ability of the viral tat gene to reduce class I MHC protein synthesis (Levinson & Jawetz ,1994.) Another mechanism hypothesized to explain the death of helper T cells is that HIV acts as a "superantigen," which indiscriminately activates many helper T cells and leads to their demise. The finding that another retrovirus, mouse mammary tumor virus, can act as a superantigen lends support to this theory (Jensen & Wright, 1989 and Levinson & Jawetz, 1994).

Persistent noncytopathic infection of T lymphocytes also occurs. Persistently infected cells continue to produce HIV, which may help to sustain the infection in vivo.

A person infected with HIV is considered to be infected for life. This seems likely to be the result of integration of viral DNA into the DNA of infected cells. Approximately 90% of AIDS patients have antibodies against HIV. However, these antibodies, which are detected by ELISA in the laboratory, neutralize the infectivity of the virus poorly. This indicates that immunity is incomplete and that infectious virus and antibodies can co-exist. In addition to the detrimental effects on T cells, abnormalities of B cells occur. Polyclonal activation of B cells is also seen, with resultant high immunoglobulin levels. Autoimmune diseases, such as thrombocytopenia, can than also occur (Jensen & Wright, 1989 and Levinson & Jawetz, 1994).

1.8.6 CLINICAL DEVELOPMENT AND PROGRESSION OF HIV INFECTION.

The clinical picture of HIV infection is divided into 3 stages: an early, acute stage; a middle, latent stage; and a late, immunodeficiency stage (O Connell, 1990 and Levinson & Jawetz , 1994)

In the acute stage, which usually begins 2-4 weeks after infection, a mononucleosislike picture of fever, lethargy, sore throat, and generalized lymphadenopathy occurs. A maculopapular rash is sometimes also seen. Leukopenia can occur, but the number of CD4 cells is usually normal. Antibodies to HIV normally appear within 2 months after infection (Jensen & Wright, 1989, Levinson & Jawetz , 1994 & O Connell, 1990). During the first 12-18 months after infection, the number of CD4 T lymphocytes decreases by about 1\3. The number of CD4-cells drops to about 700 per volume of blood as compared to a number of 1100 CD4-cells in a normal healthy individual. Although most infected individuals may appear healthy at this stage, they are capable of transmitting the virus (Kaplin, Sallis and Patterson, 1993 & McCutchan, 1990).

In the middle stage of infection, a long latent period, which may range from 3-7 years usually ensues. The patient is asymptomatic during this period, and viremia is low or absent. However, a large amount of HIV is being produced by lymph node cells but remains sequestered within the lymph nodes. This indicates that during this period of clinical latency, the virus itself does not enter a latent state. A syndrome called AIDS-related complex (ARC), can occur during this latent period. The most frequent manifestations are persistent fevers, fatigue, weight loss, and lymphadenopathy. Patients also develop minor infections such as oral candidiasis (thrush), zoster (shingles), or frequent recurrences of herpes simplex virus on the lips (fever blisters) or genitals (McCutchan, 1990). During this stage the number of CD4 cells drops at a relatively slow pace, in the range of about 80 cells per year. As with the initial stage of infection, individuals may appear to be perfectly healthy, although the virus can be spread to others (O Connell, 1990 and Kaplin, Sallis and Patterson, 1993). In the 2 year period before AIDS develops, a second accelerated period of CD4 cell depletion occurs. During this time, the number of CD4 cells may decline from 400 or 500 to less than 200 at the time of AIDS diagnosis (Kaplin, Sallis and Patterson, 1993).

The late stage of HIV infection is the AIDS stage, manifested by a decline in the number of CD4 cells to below 400 cells per volume of blood and an increase in the frequency and severity of opportunistic infections. The 2 most characteristic manifestations of AIDS are Pneumocystis pneumonia and Kaposis sarcoma. However, many other opportunistic infections occur with some frequency. These include viral infections such as disseminated herpes simplex, herpes zoster, and cytomegalovirus infections and progressive multifocal leukoencephalopathy, fungal infections such as thrush, cryptococcal meningitis, and disseminated histoplasmosis, protozoal infections such as toxoplasmosis and cryptosporidiosis and bacterial infections such as disseminated Mycobacterium avium-intracellulare and Mycobacterium tuberculosis infections (Jensen & Wright, 1989, Levinson & Jawetz , 1994 & O Connell, 1990).

The CD4 T lymphocyte-cell is not the only target for infection. Cells of the monocytemacrophage line are also susceptible to infection and may serve to disseminate infection to other organs such as the brain. The microglial cells of the brain, which are probably differentiated tissue macrophages, are also a target of HIV infection and may contribute directly to the encephalopathy encountered in these patients. This can occur even in the absence of gross immune dysfunction. Bone marrow precursor cells may also be infected directly with HIV which may contribute to the troublesome anemias and cytopenias seen in many patients (O'Connell, 1990 and McCutchan,1990).

In 1992, patients with AIDS who had no evidence of infection by HIV-1 or HIV-2 were reported. At present, it is unknown whether another virus can cause AIDS (Levinson & Jawetz , 1994). It should also be noted, that there appears to be considerable variation in the pattern of decline among individual patients. This suggests that natural defenses are partially successful in slowing the disease process (Kaplan, Sallis & Patterson, 1993). For some, the initial latency period immediately following infection may be brief, while for others, the symptoms that mark disease progression may not appear for several years. The median time from seroconversion to first AIDS-defining events appears to be 8-9 years. A recent study of individuals with known dates of seroconversion Lifson et al., (1989) in Kaplan, Sallis & Patterson (1993) found that 4 percent of that population developed AIDS within 3 years of ingestion, 10 percent within 4 years, 15 percent within 5 years, 25 percent within 6 years, 34 percent within 7 years, 39 percent within 8 years and 43 percent within 9 years. The risk of developing AIDS appears to increase with each year of asymptomatic carriage. This rising annual risk means that the longer an individual carries HIV, the more likely it is that AIDS will develop during the next year. After 8 years, about one third to one half of a group of carriers will either be ill or dead (McCutchan, 1990). It is also not yet clear, whether a fraction of carriers will resist HIV-related illness indefinitely or if virtually all carriers will develop AIDS within two decades. Just as the period of carriage of HIV can vary, survival after AIDS is diagnosed also varies widely.

Before the widespread use of azidothymidine (AZT), estimates of median survival were about 1 year (McCutchan, 1990). A small percentage (<15%) survive longer than 4 years, but full recovery of immune function is extremely rare, if it occurs at all. Treatment with AZT improves survival, but its full impact remains to be clarified. Current data suggest that AZT delays both opportunistic infections and death in AIDS and ARC patients but that after 6 to 12 months of treatment, deterioration of immunity continues in most patients. Further improvements in quality and quantity of survival through more effective drugs can be anticipated during the next decade.
The combined effects of antiretroviral agents and drugs to prevent specific infectious diseases are likely to produce incremental gains in survival, rather than a dramatic cure (McCutchan, 1990).

1.8.7 CRITERIA OF HIV ASSOCIATED INFECTIOUS DISEASES.

According to Lachman (1991) six basic principals underlie the diagnosis and treatment of HIV associated infectious diseases.

(I) Fungal, parasitic and viral infections are rarely curable; at best they can be controlled during an acute episode. They usually require long-term suppressive therapy.

(ii) Most HIV - associated infections result from endogenous reactivation of a previously acquired organism and do not represent a threat to other persons. The only HIV-associated infections that can be readily communicated are tuberculosis, herpes zoster and perhaps salmonellosis.

(iii) Infections are rarely single. Concurrent or consecutive infections with different organisms are common.

(iv) The observed frequency of certain fungal or parasitic infections depends on the prevalence of asymptomatic pathogens in the local population.

(v) Certain bacterial infections are now being recognized as HIV-associated diseases, the association may be due to defects in B cell function that have been described in patients with HIV disease. HIV infection predisposes patients to aquire surgical infections. In high incidence areas in Central Africa it may be a more frequent association than diabetes. Septic arthritis is a common presentation of HIV infection in young adults who are otherwise fit. Patients caring HIV develop an unacceptable high level of wound sepsis following implant surgery and internal fixation is avoided wherever possible.

(vi) Infections associated with HIV disease are severe, are commonly seen in their disseminated forms, and are characterized by a high density of organisms.

1.9 CLASSIFICATION SYSTEMS FOR HIV/AIDS INFECTION

Two classification systems for HIV infection are available, it is unclear however if either of these two systems has greater prognostic value than that obtained by measuring the absolute value of CD4T lymphocytes in the peripheral blood. A level less than 300-mcL is associated with a high risk of progression of HIV related diseases (O'Connell,1990).

1.9.1 THE WALTER REED CLASSIFICATION SYSTEM.

The Walter reed classification system classifies HIV infection in seven stages ranging from stage WRO to WR6 (O Connell, 1990).

During the WR0 stage, the HIV-seropositive individual is classified as having been exposed to the HIV. The WR1 stage, classifies the individual as being asymptomatically infected, i.e. the virus has been transmitted, but the individual has no physical symptoms at this stage, that reveal any disease. During the WR2 stage, individuals develop persistent lymphadenopathy i.e. enlargement of the lymph nodes, and it is at this stage that certain individuals become aware that they are experiencing a physical disorder.

Stage WR3, is defined by subclinical immune dysfunction, and is normally associated with a CD-4 T cell count of below 400. Individuals in this stage, are normally aware that they are HIV-positive. During stage WR4, further immune supression at a rate of approximately 80 CD4-T cells per year takes place, and a progressive decrease in physical functioning is observed. Stage WR5, is classical of mucocutaneous related symptomatology, and a further decline in immune status takes place. During stage WR6, opportunistic infections, for example, parasitic, fungal, bacterial and viral start to develop normally due to a CD4 T cell count of below 200. This stage is normally referred to as the clinical AIDS or full blown AIDS stage. Individuals usually become very ill during this stage, as a result of the opportunistic infections. They normally require close medical supervision during this stage, and the further declining of immune status combined with the HIV-related infections, eventually leads to death.

The authors of the original 1985 Walter Reed classification system, were more critical in their 1989 classification, and the following quote from the June 1988 report of the presidential Commission on the Human Immunodeficiency Epidemic states : "The term 'AIDS' is obsolete, HIV infection more correctly defines the problem. The medical, public health, political and community leadership must focus on the full course of the HIV epidemic rather than concentrating on the later stages of the disease.
Continual focus on AIDS, rather than on the whole spectrum of HIV infection has left our nation unable to deal adequately with the epidemic" (Lachman, 1991).

1.9.2 THE CENTER FOR DISEASE CONTROL (CDC) SYSTEM.

The center for disease control (CDC) system , classifies HIV infection into stages I-IV with subgroups A,B,C,Dand E.
On average, it takes between 7-10 years for an adult to progress from initial infection to the final clinical AIDS stage (Goeder & Blattner, 1987 in O'Connell, 1990).

There is however, tremendous variability in individual rates of progression of HIV. In infants infected at or before birth, symptoms usually appear in the first two years of life. Once the HIV infected individual has developed the clinical syndrome of AIDS, further life expectancy averages 2-3 years for adults and less for children (DeVita et al., 1988 in O'Connell, 1990).

The following (Table 1.2), clearly shows this classification.

TABLE 1.2:

CDC CLASSIFICATION SYSTEM FOR HIV INFECTION (O'Connell, 1990).

Stage	Description
I	ACUTE INFECTION
II	ASYMPTOMATIC INFECTION
III	PERSISTENT GENERALIZED LYMPHADENOPATHY
IV	OTHER DISEASES
SUBGROUP A	CONSTITUTIONAL DISEASE
SUBGROUP B	NEUROLOGICAL DISEASE
SUBGROUP C	OPPORTUNISTIC AND SPECIFIED INFECTIONS
SUBGROUP D	ASSOCIATED NEOPLASMS
SUBGROUP E	OTHER CONDITIONS

1.10 DIAGNOSTIC METHODS AND INTERPRETATIONS OF HIV INFECTION

Most screening methods for HIV infection entail detecting HIV antibodies. The use of antibody assays to determine a persons HIV antibodies status is based on two assumptions. Firstly, people who have been infected with HIV produce detectable antibody and secondly, those with detectable HIV antibody are infected with HIV.

However, neither of the above assumptions is correct 100% of the time (Lachman, 1991). Several tests are available to determine a persons serostatus but vary considerably in reliability, availability and costs. The most well known and widely used are the Enzyme-linked Immunosorbent Assay (ELISA), available for HIV-1 and HIV-2 and is a relatively simple test performed by trained technicians in clinical laboratories (Klatt, 1992 & Levinson & Jawetz, 1994). The ELISA is the standard initial test for HIV antibody and is normally vary accurate (Lachman, 1991). It is sensitive and reasonably specific but positive samples should be repeatedly tested as false-positive results are possible, as well as exhibiting a failure in detecting recent infections incurred in the 4-12 week 'window period. (The window period is the period in which HIV infection might have occurred but the HIV test may be negative or not yet indicate seropositivity) (Evian, 1993). False-positive or false-negative results can be confirmed by a more expensive, cumbersome and accurate Western Blot test (Kaplan et al., 1994, Levinson & Jawetz, 1994, Lyons, 1993 & Klatt, 1992).

The immuno-electrophorosis or immunoblot procedure, commonly called the Western Blot (WB), gained immediate acceptance as a test for confirmation of HIV seropositivity. Although the cost of Western Blot (WB) testing is somewhat higher than the ELISA, it's highly specific method of testing and it's accuracy make it the ideal confirmatory test for HIV diagnosis. The negative aspect of the Western Blot however, is that it is often not available in low resource areas, (in which case a second ELISA test should be done to help confirm the HIV diagnosis) (Evian, 1993 and Levinson & Jawetz, 1994).
When however, a sample tests neither perfectly positive or negative, the patient should be retested approximately 6 months later when an absolute diagnosis can be made (Klatt, 1992 & Levinson and Jawetz, 1994).

Although the ELISA and WB tests are the most well known and most frequently used diagnostic tests other tests are also available. These include the Abbots Test Pack for HIV-1 and HIV-2, the Du Pont HIVCHEK 1 and 2, the Colonatecs Rapid HIV 1+2 AB, Indirect Immunofluorence Assay and in situ Hybridization (Levinson and Jawetz, 1994, Lyons, 1993 & Klatt, 1992).

In most under developed countries sophisticated medical tests such as the above for HIV detection may not be available. In these countries, seropositive status is classified using at least two major symptoms. The first, is weight loss at a rate of more than 10% of the persons total body mass, and chronic diarrhea. In addition at least one other major symptom must be present, for example oropharyngeal or candidiasis, provided that no other causes for immunosuppression are present (Ijsselmuiden et al., 1988).

1.10.1 INTERPRETATION OF AN HIV-SEROPOSITIVE RESULT.

According to Evian (1993) and Lyons (1993), if the HIV test is positive:

- It means that the person is infected with HIV and can spread the virus to others during sex, through his/her blood or during pregnancy, childbirth or breast feeding.
- It does not mean that the person has AIDS.
- It does not mean that the person will definitely develop AIDS. However, many people who are HIV positive will develop AIDS within a 3-7 year period after infection.
- A positive test cannot determine when the person first acquired the infection or when the person will develop symptoms of AIDS.

1.10.2 INTERPRETATION OF AN HIV-SERONEGATIVE RESULT.

According to Evian (1993) and Lyons (1993), if the HIV test is negative:

- It usually means the person has not been exposed or infected with the HIV virus-this is a "true" negative test.
- It may however be a false negative test. This means that the person has been exposed and infected with HIV, but the test may have been done too soon after infection (1-12weeks), and he/she is still in the "window" period. If this person has a test in a further 12 week's time, the test will usually become positive, (If the person has been infected with the HIV).

1.10.3 WHEN TO RE-TEST A PERSON WHO HAS AN HIV NEGATIVE TEST RESULT.

One way to decide whether a patient should be retested again is by finding out if the patient or his/her sexual partner has been at risk for acquiring HIV in the 12 weeks before the test was done. Ask if there has been any risky sexual activity in the 12 weeks before having the test (Evian, 1993).

According to Evian (1993) and Lyons (1993) risky sexual activity may include:

- Having sex without a condom with a new partner.
- Having sex with more than one partner without using a condom every time.
- Having sex with a sex worker (male or female prostitute) without using a condom.

Other risk factors that are important include (Evian, 1993).

- Any sexually transmitted disease in the past 3 months.
- Any sharing of needles and syringes or blood transfusions in the past 3 months.

1.10.4 HIV DIAGNOSTIC SYSTEMS IN SOUTH AFRICA

Screening blood for the presence of antibodies to HIV became possible in South Africa in the second half of 1985 when the first commercial ELISA kits became available (Evian, 1993). These first generation kits were all manufactured in the USA and the HIV absorbed onto the solid phase was invariably produced in the H9 human T-cell line developed by the group of Gallo. More recently, second generation kits have emerged and use monoclonal antibodies to capture HIV proteins onto the solid phase (Evian, 1993). Kits which detect HIV antigens rather than antibodies are now also available, but not yet licensed for routine use. The positivity of specimens detected by the above ELISA's must however be verified by confirmation assays such as the immunofluorescence assay (IFA), Western blotting (WB) or radio immuno precipitin assay (RIPA) (Evian, 1993 & Govender, Marimuthu, Bubb & Conradie, 1985).

1.11 HUMAN IMMUNODEFICIENCY VIRUS DISEASE MANIFESTATIONS

The Acquired Immunodeficiency Syndrome (AIDS) is caused by the Human Immunodeficiency Virus, a human retrovirus (Kessler and Harris, 1992).
The hallmark of this disease is the progressive deterioration of immune function occurring gradually over a period of several years. T-cell, B-cell and monocyte macrophage mediated immune function are all affected. Immune dysfunction leads to increased susceptibility of a wide range of infections and neoplastic diseases that eventuate in the end stage of HIV infection, i.e. AIDS (Kessler and Harris, 1992). These infections and diseases will be described in the section that follows.

1.11.1 OPPORTUNISTIC INFECTIONS.

An opportunistic infection is an infection which occurs when immune system functioning is low and the body lacks normal defense mechanisms to protect itself.
AIDS is related to the loss of the T helper lymphocyte cell. As the T cell count falls the risk for opportunistic infections rises. The characteristic opportunistic infections of HIV patients arise from four major groups of organisms namely parasites, fungi, bacteria and viruses (Hoffman & Genz, 1990).

1.11.2 PARASITIC INFECTIONS.

Parasitic infections affect at least 80 percent of AIDS patients, the most common been Pneumocystis cariini. Other parasites which cause infections in AIDS patients are Cryptosporidium, Isosporabelli, and Toxoplasma gondii. Cryptosporidium and Isosporabelli cause chronic diarrhea in AIDS patients. Toxoplasmosis occurs in only a small percent of AIDS patients and leads to paralysis, seizures, headaches and stiff neck (Hoffman & Genz, 1990).

1.11.3 FUNGAL INFECTIONS.

Fungal organisms which cause infections in AIDS patients include Cryptococcus neoformans, Candida albicans, Histoplasma capsulatum and Coccidioides immitis. Cryptococcus neoformans is a fungus that causes meningitis with symptoms such as headache and fever. Candida infections of the mouth and throat, serve as an indicator of AIDS when the infection spreads beyond the throat into the oesophagus, causing painful swallowing. Histoplasma capsulatum and Coccidioides immitis may cause pneumonia and then spread to the liver, spleen, lymph nodes, bone marrow and central nervous system (Hoffman & Genz, 1990).

1.11.4 BACTERIAL INFECTIONS.

Mycobacterium tuberculosis causes tuberculosis in HIV-infected patients. Tuberculosis may appear as various forms of pneumonia or may occur in any other organ system (Hoffman & Genz, 1990). The other bacterial infection commonly found with HIV-infection is salmonellosis. This bacteria usually infects the gastrointestinal tract and the bloodstream.

1.11.5 VIRAL INFECTIONS.

Viral infections occur in AIDS patients as a result of immune suppression. These viruses are mainly from the herpes - group and include Cytomegalovirus (CMV), herpes simplex, herpes zoster and the Epstein Barr virus (EBV).

Each of these viruses is stored in different parts of the body, and becomes active with normal immune system suppression. CMV is transmitted sexually and occurs in 90 percent of the homosexual community. When the virus is activated, it causes inflammation in the eyes which leads to progressive blindness. It may also cause inflammation of the gastrointestinal tract causing diarrhea and bleeding (Hoffman & Genz, 1990 & Lachman, 1991).

Herpes simplex virus affects the skin and mucous membranes of HIV infected patients. It affects the mouth, lips, colon and anus. It may also cause encephalitis or meningitis. Herpes zoster is the causative agent of shingles. Shingles affects one localized area of the skin as well as the brain and liver. The Epstein Barr virus (EBV) can be isolated in the throat of many AIDS patients. It causes a lesion of the tongue called oral hairy leucoplakia, as well as malignacies in the lymph system (Hoffman & Genz, 1990 & Lachman, 1991).

1.11.6 AUTOIMMUNE DISEASE.

Thrombocytopaenic purpura, with antiplatelet antibodies and antilymphocyte antibodies demonstrated in plasma has been described in many HIV infected patients. Manifestations are as with the classical disease i.e. fever, purpura and fluctuating neurological symptoms. Thrombocytopaenia may result from the reticulo-endothelial removal of platelets from the circulation coated with immunoglobulin. Whatever the underlying mechanism the virus seems to play a central pathogenic role in HIV associated thrombocytopaenic purpura (Lachman, 1991).

1.11.7 PULMONARY DISEASE.

In adult patients, most pulmonary disease is due to infections which may be protozoal, fungal, bacterial or viral, and which are usually acute or subacute events (Bagdades, 1991, Lachman, 1991 & O Connell, 1990). Pneumocystis carinii pneumonia (PCP) is the most important opportunistic pulmonary infection. Sixty percent of patients present with PCP as their AIDS-defining illness. Unlimitedly, eighty percent will have one or more episodes of PCP during the course of their illnesses. Symptoms can range from cough and fever to severe respiratory failure. Typically, patients are breathless and distressed and have frothy sputum. Physical examination of the lungs normally shows little to clinically suggest pneumonia (Bagdades, 1991 & Lachman, 1991).

The incidence of tuberculosis (TB) has also risen dramatically in areas of high HIV prevalence, and in some TB clinics 50% of new patients are seropositive for HIV. Immune deficiency and possible transmission via inhalation devices used for aerosolized pentamidine are suspected as contributing to the spread of the infection.
The greatest incidence of TB is seen in susceptible populations such as drug addicts. Similarly, the fungal infections histoplasmosis and coccidiodosis are increased in patients in endemic areas. Viral pneumonia's due to cytomegalovirus (CMV) and varicella, have also increased in incidence. Patients are also prone to the usual bacterial causes of pneumonia (Bagdades, 1991, Lachman, 1991 & O Connell, 1990).

1.11.8 MUCOCUTANEOUS DISEASE

One of the earliest and most frequent signs of clinical immune deficiency in HIV infection is mucocutaneous candidiasis (thrush). It is present in almost every patient who meets CDC criteria for AIDS. Other mucocutaneous lesions include painful perioral and perianal ulcers due to Herpes simplex, aphthous ulceration and non ulcerative lesions such as genital warts and molluscum contagiosum. Indolent lesion due to venereal diseases may also be seen in perioral and perianal areas. Dental and oral hygiene is often poor. Poor salivary flow and dry mouth resulting from involvement of the salivary glands is frequent and compounds the problem. Oral lesions may make chewing and swallowing difficult or painful and interfere with taste and enjoyment of food (O Connell, 1990). Skin lesions such as dry, flaky skin and hair loss are almost universal late in the disease. Psoriasis, fungal and other skin rashes are common. Shingles due to reactivation of the Herpes zoster virus is common and painful and may be disseminated or multidermatomal (O Connell, 1990).

1.11.9 GASTROINTESTINAL DISEASE

Gastrointestinal disease that limits adequate nutritional intake is a major problem in late AIDS. Esophagitis caused mainly by candidal or herpetic infection can make swallowing extremely painful or impossible.

Diarrhea and malabsorption are frequent and have multiple causes, most of which have at best unsatisfactory treatment. Colitis with bloody stool may also be seen. Functional impairment is usually related to weight loss and the weakness and decreased endurance that accompanies it. However, with chronic diarrhea, frequency and looseness of bowel motions and the need to be near a bathroom may, in themselves, be major functional problems limiting a patients vocational and avocational opportunities (Lachman, 1991& O Connell, 1990).

1.11.10 BLOOD DYSCRASIAS

Many patients with AIDS are anemic, have low platelet counts, and low white blood cell counts (WBC). They present with symptoms such as breathlessness, fatigue, decreased concentration, bruising and bleeding, and in the case of low WBC, increased infections. Early in the disease auto-immune thrombocytopenia may present with bruising and bleeding. Later, bone marrow suppression may be due to HIV, other associated infections such as MAI, or treatment with AZT, or frequently a combination of all three. Frequent blood transfusions may be needed to maintain an adequate hematocrit and control symptoms such as fatigue.

Anemia and leukopenia are important side effects of AZT and are frequently the reason for failure to tolerate the drug. The absolute lymphocyte count and T-4 cell count are useful to follow progress of disease and response to treatments such as AZT. Low counts are associated with increased risk of opportunistic infections and poorer prognosis (Bagdades, 1991, Lachman, 1991 & O Connell, 1990).

1.11.11 KAPOSIS SARCOMA AND OTHER MALIGNANCIES

Kaposi's sarcoma (KS) is a highly vascular tumor of uncertain etiology. It is seen especially in the homosexual AIDS population but can also be seen in all groups with the disease, although it is rare in children.

Skin lesions are present in 90% of patients with KS. These are raised purplish plaques and nodules that are usually multiple and spreading, often coalescing into larger lesions. Initially they may be small and asymptomatic. If extensive, the skin lesions may be very obvious and readily recognized by those with experience of KS. For some patients this may pose major problems, especially if their work involves interaction with the public. Also, by identifying a person as having AIDS, cutaneous KS may contribute to his social isolation, either by causing him to be shunned or as a result of self-imposed isolation precipitated by embarrassment or fear. Indeed, the psychosocial impact of cutaneous KS may be the most disabling feature of having AIDS in some patients and may be the main thrust of rehabilitation intervention (O Connell, 1990). For patients reluctant to be exposed to the general public, modifications of work routines to allow work from a home setting using personal computers and telephones may be possible for a lucky few. For others, the therapist may devise home exercise programs and find alternative ways to increase outside activities in a protected environment. Physical problems may be caused by cutaneous KS lesions if they are in pressure areas such as the sole of the feet where abrasion, bleeding and superficial infection can greatly limit ambulation. However, it is the dissemination to visceral organs and lymph nodes that causes much of the associated morbidity (O Connell, 1990).

Obstruction of lymphatic drainage may cause progressive edema of the lower extremities and scrotum, causing difficulty fitting shoes and clothes, discomfort from stretching of tissues, and increased risk of superficial infections (Bagdades, 1991, Lachman, 1991& O Connell, 1990). KS lesions in the mouth, pharynx, and esophagus may make swallowing difficult or impossible. Involvement of the gastrointestinal tract may cause slow oozing of blood or interfere with absorption and nutrition (O Connell, 1990).

1.12 HIV-SEROPOSITIVITY AND THE POSSIBILITY OF A VACCINE.

The development of a vaccine for the prevention of HIV/ AIDS will require a more detailed knowledge of the role of different immune responses and the most effective way for the generation of particular responses. A vaccine capable of producing effective immunity to HIV in the general population could be decisive, but the task of producing such a vaccine that is stable against an antigenically unstable retrovirus is technically formidable. During the pathogenesis of HIV infection, the HIV recognizes the CD4 molecule and has tropism for T- cells i.e. CD4+ T- cells (Evian, 1993 & Lachman, 1991). The main reason for the devastation of AIDS is the lethal viral effect on the T cells that are required for an effective immune response to foreign antigens. One must be careful not to harm those cells and cytotoxic T8 cells, and also the major source of Interleukin 2 and other cytokinenes, this tropism is sufficient to explain many immunological manifestations of the disease. Further, HIV-1 is subject to unpredictable variations and the recent isolation of HIV-2 adds to the problem.

Even more recently the French have reported the isolation of at least three HIV-2 like viruses and this further compounds the issue. Yet only 0,01% of T4 cells are actually infected and some other factor must cause the demise of the T4 cells (Lachman, 1991). It has recently been emphasized that CD4 bearing T lymphocytes are not the only target for the Human immunodeficiency virus, the HIV can also infect macrophages and cells of the gastrointestinal tract, kidney, brain, lung and other tissues.

A vaccine containing recombinant GP120 and GP160 viral envelope glycoproteins has been shown to protect non-human primates against challenges by HIV and HIV-infected cells and has been formulated with moderate success for people. Success has already been achieved by a vaccine that contains a live, attenuated mutant of HIV which is able to protect monkeys against challenges by large doses of HIV. These experimental findings encourage further research along similar lines with a mutant form of the HI viruses in human beings (Giraldo, 1992, Levinson & Jawetz, 1994, Kaplan et al., 1993 & Klatt, 1992).

It is important to note however, that since most experiments carried out in animals were in the nature of feasibility studies, even if the protective elements could be defined therein, they might not necessarily apply to the more complex situations which occur during natural transmission (Bolognesi, 1992). Otherwise stated, immunity which is effective against experimental inocula with a given laboratory strain may not be effective against a highly divergent isolate, a mixture of natural isolates and even less likely against inocula consisting of both virus and infected cells.

The remaining issues of how to raise cross-protective immunity that will be effective against the existing swarm of HIV isolates under natural modes of transmission, will require that major gaps in the current knowledge base be filled. These include basic issues such as how to correlate virus variation with antigenicity, escape from immune defenses, viral transmission, tissue tropism and pathogenesis. Equally important is the necessity to develop new insights into vaccinology principles that would deal with the unprecedented variability of HIV and how to elicit secondary immunity within the setting of comprehensive systemic immunity (Bolognesi, 1992).

1.13 PREVENTION AND CONTROL OF HIV INFECTION AND AIDS.

As to date no cure or preventative vaccine exists for AIDS, prevention and control of AIDS will arise through education and through applying methods to test and screen individuals for the presence of the virus. Persons in high-risk groups such as intravenous drug users, homosexuals and bisexuals, recipients of blood products, prostitutes and heterosexuals with multiple sexual partners, are encouraged to be regularly tested for exposure to the virus.

1.13.1 PREVENTION OF AIDS AS A SEXUALLY TRANSMITTED DISEASE

Aids can be seen to be predominantly a sexually transmitted disease within the homosexual and heterosexual community. Any individuals who engage in high risk sexual practices are at risk for contracting the HIV virus. High risk sexual practices include any sexual practices during which there is an interchange between individuals blood or body fluids containing the virus. Receptive anal intercourse between males is thought to be an especially high risk activity for the transmission of HIV. The number of sexual contacts further affects risks, as does contact with partners who would be at a greater risk of having HIV (e.g. prostitutes) (Miller, 1987). Control and prevention of HIV infection is possible through safer sexual practices. This would include sexual activities with a low potential for transmission as well as the use of barrier contraceptives and spermicides. These methods have also been shown to be effective in decreasing the transmission of sexually transmitted diseases (Miller, 1987).

1.13.2 THE ROLE OF EDUCATION AND INFORMATION IN PREVENTING THE SPREAD OF HIV.

The target groups for AIDS education and awareness were the original high risk groups. The gay population as a group has managed to market safe sex and this has in fact led to a change in sexual practices in the gay community. Many couples have become monogamous or have become involved in safe sex practices. However, Berger (1990) notes that 69% of gay people still do not use condoms.

Intravenous drug-abusers and addicts have had even less success than the gay community in changing their habits and curbing the spread of the disease. Experts have attempted individual counseling and the supply of clean equipment. However, these attempts have been very discouraging because of the fact that only a small percentage of drug users are in treatment programs and have access to these facilities.

In addition, the exchange of needles has been opposed by sections of the public who believed that nothing should be done to encourage I.V. drug use (Hoffman and Genz, 1990). In Africa, transmission of AIDS is high in heterosexual populations. This is because social and cultural factors tolerates a high level of sexual activity and having several partners whether the person is married or not is acceptable. In addition, migrant labor and urban migration tends to encourage prostitution and homosexual activities. Traditionally, many African countries have denied the existence of AIDS and thereby allowed the disease to become firmly established before any preventative measures were taken (Bennett, 1987).

Prevention and control of AIDS in the blood supply has also been made possible through screening every donated blood unit for the presence of HIV antibodies. In addition, an attempt has been made to screen out donors who are at a high risk for AIDS. These include donors who have had homosexual or bisexual contact, hemophiliacs and their sexual partners, residents of central African countries, people who have had sexual contact with individuals with AIDS or ARC, people who have engaged in prostitution since 1977 or have had sexual contact with someone who themselves have had sexual contact with a homosexual, bisexual, Intra-Venous (I.V.) drug user, prostitute or hemophiliac. Despite these precautions, blood supply cannot be considered completely "safe" because blood donors may not test positive at the time of their blood donation. As a result units of infected blood can slip through screening procedures (Hoffman and Genz, 1990).

1.14 CURRENT MEDICO-PHARMACOLOGICAL TREATMENTS FOR HIV RELATED INFECTIONS AND DISEASES.

The development of progressive and severe immunosuppression is the hallmark of HIV infection. The diminished host defenses allow the development of pathological states by a variety of opportunistic organisms which along with malignancies are the major causes of mortality and morbidity in AIDS patients.

In addition some of these organisms may play a further role, acting as "cofactors" in the complex pathogenesis of HIV related diseases (Bagdades, 1991).

Of all the medico-pharmacological treatments that have been used for HIV infection, it would appear that only the drugs Azidothymidine or zidovudine (AZT), and Dideoxyinosine (ddi) in combination with saquinavir (a protease inhibitor), have had any significant impact on the progression of the disease. Although these drugs have the ability to improve the immune status of HIV infected persons, they do have numerous side effects, such as supression of the bone-marrow, which can cause anemia and a drop in the white blood cell count, which in turn may increase the likelihood of opportunistic infections. The available pharmacological agents are also limited in their effect, to prolongation of the onset of clinical symptomatology and final mortality and do not constitute a cure for HIV infection or AIDS.

1.14.1 MEDICO-PHARMACOLOGICAL TREATMENT FOR PNEUMOCYSTIC CARINII PNEUMONIA (PCP)

PCP, has been the commonest AIDS defining illness. Initial mortality rates were of the order of 20% or above, but these have dramatically improved to about 5% over the last few years, even for patients with severe hypoxia at presentation (Bagdades, 1991).
Treatment of PCP is usually with trimethoprim-sulphamethoxazole (Bactrim/Septrim), or pentamadine, and response is better in early treatment (Bagdades, 1991).
Intravenous pentamidine is however considered to be potentially nephrotoxic and can also cause abnormalities in glucose metabolism, hypotension and cardiac arrhythmia's. Chronic prophylaxis with oral or aerosolized medication is also indicated to prevent recurrence of PCP (Bagdades, 1991& O Connell, 1990).

1.14.2 MEDICO-PHARMACOLOGICAL TREATMENT OF MUCOCUTANEOUS -INFECTIONS

Most patients with AIDS are on maintenance therapy with antifungal lozenges and receive acyclovir when indicated for herpetic lesions. Careful oral hygiene, use of antiseptic rinses, and anesthetic gels or solutions are recommended (Bagdades, 1991& O Connell, 1990).

1.14.3 MEDICO-PHARMACOLOGICAL TREATMENT OF GASTROINTESTINAL INFECTIONS

Where specific treatment is lacking, symptomatic management with antidiarrheals and a major effort to maintain adequate calorie and protein intake are needed to prevent progressive weight loss. A manageable plan of meals, snacks and supplements that is appropriate for the individual patient may be helpful in avoiding more aggressive nutritional supplementations, such as tube feeding and intravenous parenteral nutrition, (Bagdades, 1991 & O Connell, 1990).

1.14.4 KAPOSIS SARCOMA AND OTHER MALIGNANCIES MEDICO-PHARMACOLOGICAL TREATMENT

Chemotherapy and use of biological agents such as Alpha-interferon may be of some use in disseminated disease. Radiation may be used to control locally troublesome lesions. Irradiation of the feet is very helpful for KS of the soles (Bagdades, 1991).
Lesions in the oropharynx causing obstruction in swallowing or respiration may also benefit from irradiation. In the short term, however, this may aggravate mucosal ulceration and dysphagia. If lesions break down and become infected, whirlpool treatments may be needed to assist debridement and healing. Standards of disinfection for whirlpools after use must be established and followed meticulously.

Lesions on the soles of the feet may require unweighting of feet via walkers or crutches, the use of soft plastizote inserts to decrease friction and extra-depth or cast shoes. Control of edema via compression garments is needed when lymphatic obstruction or dependent edema occurs and may reduce the effort of moving heavy swollen limbs (Bagdades, 1991 & O Connell, 1990). Novel treatment for KS includes targeting of lesions with a recombinant fusion protein composed of human-interleukin 2 and cytotoxic fragments of diphtheria toxin. Facial KS is less life threatening but very distressing for patients and one German group concentrated on palliative modalities for this. They concluded that liquid nitrogen is the therapy of choice for small (<1cm) lesions and that intralesional chemotherapy was helpful for more extensive disease (Bagdades, 1991).

1.14.5 ANTIVIRAL MEDICATIONS

At present there are a number of antiviral drugs used to slow down the progression of HIV disease progression. Azidothymidine (AZT) and Dideoxycytidine (DDI) are however, the 2 most common and widely tested drugs used for treatment in the advanced stages of HIV infection (Kessler & Harris, 1992). They are also the only pharmacological agents in combination with saquinavir (a protease inhibitor), that have had any significant impact on the progression of the AIDS disease.

1.14.5.1 AZIDOTHYMIDINE -(AZT)

AZT, was the first nucleoside analog reverse transcriptase inhibitor to be studied and used for its activity against the HIV. The drug was originally synthesized as an anticancer agent in 1960 (Kessler & Harris, 1992). AZT, is an antiviral agent which has been shown to prolong life for several months by reducing the risk of contracting opportunistic infections (Schopper & Walley, 1992). AZT has been found to be well absorbed orally with peak serum concentrations occurring 0.5 to 1.5 hr after a dose. The recommended dose of AZT is approximately 3.0 to 3.5 mg/kg every four hours (Kessler & Harris, 1992).

Long-term follow-up data for patients treated with AZT for 12-18 months have indicated an overall increase in period/rate of survival of between 70-90%. Patients have also experienced improvements in neuropsychological functioning (Kessler & Harris, 1992). AZT is however, limited in it's usefulness due to firstly, it's high cost and in addition, elaborate patients monitoring is necessary due to drug toxicity (Schopper & Walley, 1992). Side-effects range from physiological effects like bone marrow suppression, headaches, insomnia, myalgias and nausea, to psychological effects such as depression and acute manic syndrome (Antoni, Schneiderman, Fletcher, Goldstein, Ironson, & Laperriere, 1990 & Kessler & Harris, 1992). A number of neurologic side-effects to AZT have also occurred. High plasma levels of the drug have been associated with tremors and confusion (Kessler & Harris, 1992).

The pharmacological treatment of opportunistic infections differs according to the opportunistic disease resulting from the virus, which would also include anti-depressants for depression (Schopper & Walley, 1992).

1.14.5.2 DIDEOXYCYTIDINE-(DDI)

Dideoxycytidine (DDI), is one of the most recent dideoxynucleoside purine analog to be clinically evaluated. Intracellularly, it is enzymatically converted to dideoxyadenosine ddA, which in turn is triphosphorylated to the active compound. Bioavailability is 35% when given orally, primarily due to acid liability. Antacids must be administered concomitantly. The anti-HIV activity of ddI, is measured by decreases in HIV-Ag. The most frequent side effects have involved the CNS with headache, insomnia and irritability. Patients have also experienced seizures, peripheral neuropathy, and pancreatitis. Toxicities seem to be directly dose related and this will require further monitoring (Kessler & Harris, 1992).

1.14.5.3 ACCEPTANCE OF AZIDOTHYMIDINE (AZT) TREATMENT IN ASYMPTOMATIC HIV DISEASE: THE ROLE OF HEALTH BELIEFS.

While the value of AZT therapy in advanced HIV disease is well established there has been, and remains still, debate over the use of AZT in early HIV infection, and in particular in asymptomatic individuals (Catt, Stygall, Catalan, 1995).

From the results obtained by a study conducted by Catt et al., (1995) it would appear that looking at a patient's health beliefs can be a way of gaining a picture of how asymptomatic individuals may come to view early AZT therapy in relation to their own treatment decision and HIV disease. Treatment acceptors of AZT in early infection have a clear need to see the beneficial side of therapy come out on top and claim to have been told by their doctor to initiate treatment. Decliners, on the other hand, justify their actions by interpreting the balance between costs and benefits tipped in the other direction. They tend to claim that their doctor has not told them to initiate early treatment, and they would appear to be waiting for bodily symptoms to cue their actions. Based on Festinger's Theory of Cognitive Dissonance, beliefs expressed by the two patient groups would be those which remove inconsistency between actual behavior and the belief held, thus achieving cognitive harmony (Catt, Stygall, Catalan, 1995). The key to these psychological explanations is the fact that individuals will hold beliefs which might be expected to support or fit in with their own behavior. It is suggested that it may be useful for health professionals to be aware of the role of beliefs. Identification of those health beliefs which individuals use to support or explain their acceptance or rejection of early therapy may help the doctor to understand his/her patient better (Catt, Stygall, Catalan, 1995).

1.15. PSYCHOSOCIAL ASPECTS OF HIV TESTING

1.15.1 THE HIV ANTIBODY TEST: PSYCHOSOCIAL ISSUES

Why would a person take the HIV test? This question continues to be debated. An increasingly popular view is that testing may help contain the spread of AIDS by reducing transmission of the virus and that it will promote health-enhancing behavior among those who are already infected but asymptomatic (Buckingham, 1987). In contrast, other experts believe that in the absence of curative treatment, antibody testing can only precipitate a psychosocial crisis. Based on the view that everyone should adhere to safe sex guidelines, some perceive the testing as a psychological assault that only creates stress, which in turn further weakens the immune system. On a more personal or idiographic level, an individual's unique psychological issues may motivate him or her to take the test. Preexisting issues may be reactivated by awareness of the AIDS crisis. Many individuals who are concerned about their own health and about AIDS may seek antibody testing as a way of reducing anxiety when in fact other issues may be responsible for their worries (Buchingham, 1987 & McCann & Wadsworth, 1991)

1.15.2. DISCLOSURE OF HIV TEST RESULTS.

Careful consideration must be given to the disclosure of HIV-antibody test results. Although antibody testing has become a common practice, very little is known about the impact of a positive test result on a person or about the factors that may play a role in his or her coping response. An individual's social support system (often a function of one's social subgroup status, such as "gay men") may serve as one indicator of his or her ability to adjust to the notification of a positive antibody test. In contrast to heterosexual men and women, gays have been gradually exposed to more concentrated information about the AIDS crisis over a longer period. Prior personal knowledge of the disease via close friends or lovers may affect how well one received positive test results. For example, awareness of the numerous social and community supports available and the knowledge of how these agencies have served friends or lovers may help cushion the trauma of one's own seropositivity.

In contrast, watching the physical decline of a loved one may heighten a person's fear of developing AIDS and thus contribute to a more pessimistic reaction. With marginal support in the heterosexual community, straight men and women who test positive may feel very isolated and lacking in social support systems (Buckingham, 1987 & Pergami, Catalan, Hulme, Burgess & Gazzard, 1994).

1.15.3. PSYCHOSOCIAL ISSUES OF HIV SEROPOSITIVITY.

There remains some concerns about individuals who receive negative test results (presumably indicating no HIV exposure). To be sure, such a test result represents good news. However, because of the three-month seroconversion range and the margin for error in testing, the post-testing period is a particularly good time to provide information and education to the person who tests negative. The fact that one has felt a need to take the test raises some questions that should be considered. This situation presents an opportunity to provide information tailored to the individual that may make the difference between health and illness (Buckingham,1987). A positive antibody-test result on the other hand, often precipitates a major psychosocial crisis. Although many persons may believe they feel prepared for a positive test result (indeed, they may "expect" it), in reality, confirmation of exposure often ushers in a time of emotional disintegration. One client, who had early symptoms of AIDS Related Complex (ARC) and whose lover recently had died of AIDS stated when he was told he was HIV antibody -positive, "I couldn't believe it! I was stunned for several days. Down deep, I believed it wouldn't happen to me."

The confirmation of one's hidden fears may well throw an individual into an acute, unexpected crisis that, beyond the medical issues, further intensifies the need for effective and timely intervention (Buckingham, 1987 & Pergami et al., 1994).
The uncertainty of the implications of a positive test result may cause the individual to struggle with what may seem an intolerable ambiguity. In an attempt to eliminate this uncertainty, many individuals may interpret a positive result as a "death certificate" and begin to grieve the anticipated and feared loss of a healthy self.

The lack of definitive medical knowledge and the absence of curative treatments further reinforce a crisis reaction. Currently, research drugs and experimental protocols offer the only glimmer of hope. However, persons who test HIV-positive but do not meet the diagnostic criteria for AIDS or ARC may find themselves unable to obtain these new drugs, and their subsequent frustration and anxiety only compound the crisis situation.

One's personal experience with AIDS may also exacerbate anxiety. For example, individuals who have no experience with or information about the disease may react on the basis of the "horror stories" and distortions of fact that they have heard from acquaintances or the news media. An individual who has seen others ill or dying with the disease may be highly sensitized and may quickly panic upon learning of his or her own antibody status, assuming that he or she will meet a similar fate (Buckingham, 1987). Still others may be "AIDS experts" in that they have done volunteer or career work with AIDS patients. For these individuals, certain protective denial mechanisms may be less available. This broad range of factors may affect an individual's reaction to the antibody-test result, which illustrates the crucial need for a thorough assessment of each patient's background in terms of what the test results may mean to him or her.

The clinician involved with an HIV antibody-positive individual should always assess the patient for level of suicide potential as well as for the degree and type of social supports available to him or her. Additionally, an assessment of the patient's level of ego strength and the ways in which he or she has coped with medical illnesses and crisis in the past may help determine how the individual will respond to the current crisis.
Such an assessment in turn, provides the foundation for an effective and individually tailored plan of intervention (Buckingham, 1987 & Jacobsen & Perry, 1990).

1.16. HIV POSITVE DIAGNOSIS: PSYCHOLOGICAL - IMMUNOLOGICAL AND SOCIAL IMPLICATIONS

1.16.1. A PSYCHOLOGICAL AND AN IMMUNOLOGICAL DISEASE.

Hall & O'Grady, (in Mays, Albee & Schneider, 1989) allege that AIDS consists of two diseases. Initially, the individual must deal with the subsequent anxiety and psychosocial sequelae associated with knowing that one has a disease for which there is currently no available cure, followed by a disease caused by and involving the destruction of the immune system. Thus, AIDS consists of a number of neuropsychiatric and psychosocial complications which inter-relate with the functioning of the immune system (Ironson, LaPerriere, Antoni, O Hearn, Schneiderman, Klimas & Fletcher, 1990).

1.16.2. SPECIAL CHARACTERISTICS OF HIV-SEROPOSITIVITY AND THE AIDS DISEASE

1.16.2.1. STIGMATIZATION

High risk groups, that is homosexuals, prostitutes, intravenous drug users and blacks tend to be characterized by negative stereotypes which influence the general social perceptions of AIDS sufferers. Stigmatization results in reactions of fear, intolerance, rejection and blame (Crewe, 1992). Studies conducted on the attitudes of South African health care workers revealed an array of unconscious negative feelings projected towards homosexuals and black sexuality (Schlebush & Cassidy, 1995).

As a result many sufferers feel isolated and rejected by family, friends and the health care sector which is further complicated by emotions of guilt, anger and disempowerment. This loss of interpersonal and institutional support may be detrimental to the sufferer as the individual no longer has sufficient resources to buffer the stressors involved and subsequently has to deal with disease alone.

Herek and Glunt (1988) further report that seropositivity is associated with two major sources of stigma. Firstly, it is an incurable and progressive disease which is associated with death. Secondly, the virus is transmitted by stigmatized groups such as gay men.

Blendon and Donelan (1988) found that between 21% and 40% of people in their survey favored barring people with AIDS from public places. In addition, over 50% said that they would refuse to work with someone who had AIDS. Furthermore, a substantial percentage saw AIDS as punishment for immoral behavior.

1.16.2.2. PROGRESSIVE NATURE OF HIV INFECTION

Hoffman (1991) suggests that HIV disease should be conceptualized as a chronic, progressive disease which has vast psychosocial implications.
Lopez and Getzel (1984) note that people with HIV disease are often unable to return to normal functioning or equilibrium (Moos 1988) because one medical crisis is usually followed quickly by another crisis.

1.16.2.3. TIMING

The timing of diagnosis also serves to limit one's adaptation to the crisis. Neugarten (1979) speaks of on-time and off-time events. HIV can be seen as an "off-time" event because it is unexpected and unplanned for. In addition, such a diagnosis comes at a point in the individual's life when he is not expecting to become ill. Hoffman (1991) notes that 22% of people with AIDS are in their twenties, 47% in their thirties and 22% in their forties.

Moynihan, Christ and Silver (1988) examine the importance of the individual's developmental stage as well as the social context of the disease in dealing with the disease. They argue that the individual's ability to fulfill the developmental tasks of his particular stage, ie. young or middle adulthood is challenged by the demands of dealing with HIV/AIDS .

In addition to disrupting the psychosocial stages of the individual's development, an HIV-positive diagnosis often forces the individual to negotiate tasks which would normally be relegated to his final years. Tasks such as coping with the deterioration of mental and physical abilities as well as coping with death are idiosyncratic for the individual in early or middle adulthood.

1.16.2.4. SOCIAL SUPPORT

Hoffman (1991) states that, the individual's ability to cope with an HIV - positive diagnosis is partly dependent on the support he receives interpersonally and through institutional support systems. Zinch and Temoshok (1987) suggest that social support may act as a buffer against stress. Kurdek (1988) found that men who received more social support from their partners after diagnosis showed fewer psychological symptoms such as depression and anxiety. Kurdek (1991) found that social support from one's partner was positively related to psychological adjustment. Not only is it important for the individual to receive support from his partner in the context of a primary relationship, but the type of support received is important in coping with diagnosis.

Hays, Catania, Mukusick and Coates (1990) found that emotional, practical, and informational support were all inversely correlated with depression in the HIV positive individual. Satisfaction with informational support was especially important for men experiencing HIV - positive symptoms.

Hays et al., (1990) note that this may be the reason why family members are perceived as less helpful to the HIV - positive individual, than are partners and friends.
The other possibility is that as Hays et al., (1990) note, many of the demands that HIV - positive people place in friends and family are difficult to satisfy.
These issues may be best dealt with by the individual, who is involved in a primary relationship with the HIV - positive individual. The nature of this relationship may be better suited to dealing with such extraordinary demands as caregiving.

1.16.2.5. THE INDIVIDUAL'S PERCEPTION OF HIS SITUATION.

A very important element which affects the individual's adjustment to diagnosis is the individual's perception of his situation. This includes the source of the infection, the stage and the timing of the infection.

1.16.2.5.1. THE SOURCE OF INFECTION

Weiss (1988) argues that many HIV - positive individuals have a need to understand how they contracted the disease. Knowing who one contracted the disease from and when one contracted the disease helps the individual to attribute blame either to himself or others. Often such attributions are associated with feelings of guilt and shame.

1.16.2.5.2. STAGE OF INFECTION - ASYMPTOMATIC OR SYMPTOMATIC.

The crisis potential of the diagnosis will depend to some extent on when in the progression of the AIDS disease diagnosis takes place. In cases where the individual is largely asymptomatic and a positive diagnosis is made, the individual is unprepared, the event therefore has great crisis potential.

If a diagnosis is made when the individual is already symptomatic, he may be expecting a positive diagnosis. Although diagnosis may be planned for, the implication for this individual is that he is further along the continuum of HIV disease, ie. he is not only HIV - positive, but may be developing AIDS related complex or even full blown AIDS. However, when the individual is in the asymptomatic phase of the disease, often he has a choice of whether or not to be tested. If he decides to be tested he is able to prepare himself for the results. Sometimes the mode of onset of the disease is sudden and without warning. If this is the case the individual has no choice with regard to testing and is largely unprepared.

Reiss and Kaplan-de Nour (1989) describe various modes of onset of HIV disease. One mode of onset is termed "incidental". In such a case the individual is largely asymptomatic and suffers no discomfort or illness. Unexpectedly as a result of a routine examination the individual discovers he has a Kaposi's sarcoma lesion which is a symptom of full blown-AIDS. In such a case the individual is totally unprepared for his diagnosis. A similar mode of onset has been described by Reiss and Kaplan - de Nour (1989) as the "medical thunderbolt". Here the individual is asymptomatic and without warning becomes ill with life threatening symptoms, such as cytomegalovirus or AIDS dementia. Once again diagnosis is particularly traumatic because the individual is unprepared. Reiss and Kaplan-de Nour (1989) describe two modes of onset when the individual is already symptomatic. The individual may experience the symptoms of AIDS related complex such as fatigue, weakness and loss of appetite.

These symptoms may prompt the individual to be tested. At this stage the individual may suspect that he has the HIV virus. If a diagnosis is made at this stage the individual may be expecting the result, but may still be unprepared.

The second mode of onset which occurs in the symptomatic individual is when diagnosis takes place in the later stages of AIDS related complex. At this stage the individual is prompted usually on medical advice to be tested for the virus. Usually the individual is experiencing neurological symptoms as well as early phase wasting syndrome. He may be suffering from opportunistic infections marking full blown AIDS. The individual who is diagnosed at this late stage is prepared through counseling for his diagnosis, however, diagnosis is especially traumatic given the advanced stage of his illness.

1.17. PSYCHOLOGICAL RESPONSES TO HIV INFECTION.

The AIDS disease should be seen on a continuum that stretches from asymptomatic infection to severe symptoms and disability or death varying in period from three to fifteen years.

1.17.1. DENIAL

Miller (1987) reports that immediately after diagnosis the individual is likely to suffer from shock. He is likely to feel confused and experience denial. He may become withdrawn and quiet or may "break down", using abusive language and physical aggression. Miller (1987) notes that regardless of how well prepared the individual is to receive the diagnosis, he is facing a life threatening issue of "life or death" significance.
Miller (1987) states that the shock of diagnosis may continue for days or many months.

Earl, Martindale and Cohn (1991) note that denial is a normal response to a traumatic event such as being diagnosed as HIV positive.

The American Psychiatric Association defines denial as "A defense mechanism operating unconsciously, used to resolve emotional conflict and allay anxiety by disavowing thoughts, feelings, wishes, needs, or external reality factors that are consciously intolerable" There are different denial styles some of which are useful for the HIV-positive individual.

Earl et al., (1991) suggest that denial can be seen as existing in four clusters. Firstly Primary Denial, usually occurs within the first month of diagnosis and it includes an ability to discuss the realities of the diagnosis and engage in appropriate social behavior. It also includes the incorporation of support system members into the resolution of the problem.

The second denial style is known as Secondary Denial. This type of denial is evidenced approximately a month after diagnosis. It includes rebelling against the treatment team, and the maintenance or escalation of identified self harming behaviors, such as alcohol or drug abuse. It also involves manipulation behavior such as suicidal gestures.
The third denial style is known as Denial without Benefit, or deferred action. Individuals using this style of denial deny their HIV condition and participate in selective admissions, while maintaining four behaviors.

These include:
- no involvement with treatment, except during a health crisis.
- no decrease in high risk sexual activities or substance abuse.
- no disclosure of status to friends or family and a tendency to lie if asked.
- a nonchalance when confronted with their sexual irresponsibility. In addition, a tendency to blame others for their condition.

Earl et al., (1991) contend that secondary denial appears to be the most conducive style in adaptation to HIV disease. This is because individuals who followed this style of denial were the closest to Earl et al.'s model of successful adaptation.

1.17.2. ANGER.

Anger, is another type of psychological response which people with AIDS reportedly experience. Infected individuals experience considerably higher levels of anger than people who are not HIV positive and this may be due to being infected from possible high-risk life-styles, behaviors and activities. Anger may be self-directed or directed towards others. It may also be directed at the people closest to the AIDS sufferer who, in turn, may become angry because their loved one is going to die, the confronting situation seems hopeless and the impression that the virus is an unconquerable mountain exists. Fears about the illness progression, social discrimination and stigmatization cause insecurities that may possibly arouse anger towards ones self or society.
The lack of an effective means to treat the virus combined with little hope for a medical solution available in the near future, contribute even further to a low of personal sense of control over the situation (deJongh van Arkel, 1991, Pizzi & Johnson, 1990 and Price et al., 1986).

1.17.3. STRESS AND ANXIETY.

An HIV-positive serostatus notification may be characterized as a major source of stress and anxiety. The stress involved is immense, resulting in an adverse impact on mental health (Kelly & Murphy, 1992 & Miller, 1987).

Studies conducted by Ironson and colleagues (1990) and McCann & Wadswarth (1991) revealed that the stress involved in waiting for the test result is immense and the anticipatory period may be viewed as a potent psychosocial stressor which results in adverse changes in affect and cognition which further impairs immune functioning . This not only occurred in individuals who were eventually identified as HIV-positive, but also in subjects who tested negatively for the virus. A traumatic experience threatens one's personal resources and well-being. One begins to question the resilience of the self and one's fundamental perceptions of life (Borden, 1991).

Schneiderman (1992) includes distress and depression, uncontrollable stressors, social support and coping strategies as important psychosocial and behavioural sequelae of the HIV\ AIDS disease.

Miller (1987) notes that anxiety usually centers around the following issues. Firstly, the possibility of infecting others with the virus as well as the possibility of being abandoned by others and of being left alone in pain. In addition these people fear social, occupational, domestic hostility and rejection. Miller (1987) further notes that anxiety also centers around the ability of partners, lovers, friends and family to cope with HIV infection and its problems. In addition patients are concerned about the availability of medical treatment. These people are also anxious about loss of privacy and confidentiality as well as loss of physical and financial independence. They also fear being socially and sexually unacceptable.

Common symptoms of anxiety include agitation, nervousness as well as physical symptoms such as muscle tension, nausea, heart palpitations, dizziness, sleep difficulties, physical fatigue, mood changes and loss of sexual drive.

Miller (1987) states that where anxiety is chronic the individual may begin to experience panic attacks. Many individuals misinterpret the psychological symptoms of anxiety as being the physical symptoms of HIV infection. The reactions, concerns and psychological themes of the identified HIV/AIDS sufferer has been shown to be similar to terminally ill cancer patients (Chuang, Devins, Hunsley, & Gill, 1989 & Kelly & Murphy, 1992). However, due to stigmatization and the difficulty found in predicting the course of the disease; it also involves additional unique stressors such as a prolonged experience of uncertainty (Borden, 1991) and the fear of the unknown (Chuang et al., 1989).

1.17.4. DEPRESSION-DISTRESS AND HELPLESSNESS.

Miller (1987) found that depression is one of the most common psychological reactions to HIV infection especially in the period shortly after testing. This is because at this time the individual is likely to see his physical decline as inevitable. In addition, because of the absence of a cure for the HIV, the individual is likely to feel helpless and hopeless. Depression is also likely to result from a change in lifestyle, for example when the individual experiences reduced physical functioning and occupational restrictions. Even the anticipated loss of these functions may contribute to depression. Consequently severe depression may interfere with adjustment to and decision making regarding HIV.

Miller (1987) notes that many individuals with HIV infection exhibit the following symptoms: depressed mood, feelings of worthlessness and guilt, low self esteem, helplessness, suicidal thoughts, thinking difficulties, obsessions and paranoia, and a loss of interest or pleasure in previously enjoyed activities.

In addition to the above psychological symptoms, physical symptoms such as loss of energy, loss of appetite and weight, sleep disturbance and loss of sex drive may also exist in the depressed person.

Lovejoy (1992) notes that depression may be the result of organic or non-organic causes. Non-organic causes include absence of rewards, loss of control and distorted thinking. The HIV positive person and his partner may become depressed as a result of having withdrawn from rewarding activities and people in their environment. In addition loss of social support from one's environment may contribute to depression.
The incidence of depression and sustained distress levels are high throughout the course of the disease. The suicide rate has been shown to be 36 times higher amongst HIV and AIDS sufferers than the normal population (Hays et al., 1992 & Schneiderman, 1992) although Chaung and colleagues (1989) report conflicting results. Suicidal ideation occurred infrequently in their sample of HIV sufferers.

Disempowerment and a feeling of helplessness occur as a result of uncontrollable stressors. These include the overt signs of progressive physical and neurological deterioration, the stigmas associated with a positive diagnosis and practical issues like increasing medical costs and the loss of medical insurance (Schneiderman, 1992). These stressors are beyond the individuals control and in South Africa are further compounded by social unrest, limited medical support and the lack of suitable housing (Dommisse, 1987).

1.17.5. LOSS OF CONTROL

The individual with HIV infection is likely to feel a loss of control because of the potentially destructive virus which seems to have taken control of his life. As a result of a drop in self-esteem, the individual may withdraw and avoid any attempt to gain control of his life. He is likely to experience a sense of helplessness.

Miller (1987) notes that the HIV positive individual may develop a way of thinking which includes selective perception. In addition he may engage in awfulising, catastrophising and making overgeneralisations. This leads to an inflexible way of looking at the AIDS disease.

The HIV individual is likely to have a negative view of himself, the world and the future. Miller (1987) contends that many people develop an obsessional degree of worry about their HIV status. This may involve the drive to find a cure for the AIDS disease. It may involve very strict health regimes and obsessive attempts to keep one's thinking positive. Miller (1987) states that these regimes are in themselves stressful because they allow the individual no room for flexibility or relaxation but instead leave him feeling restricted.

1.18. COPING STRATEGIES AND SKILLS THAT AFFECT THE PSYCHOLOGICAL ADJUSTMENT OF HIV- SEROPOSITIVE PATIENTS.

1.18.1. CLIENT CHARACTERISTICS

Individual client characteristics play a role in his adjustment. The first of these as noted by Hoffman (1991) is that of psychosocial competence. These are person variables that explain a person's success or failure in handling life events. Secondly self-esteem is likely to play a role in adjustment to HIV disease.

Bandura (1987) argues that self efficacy refers to one's beliefs about one's capabilities, and one's ability to control one's social environment. Consequently one's perception of control over HIV disease may have implications for one's adjustment. Apart from one's psychosocial competence, self esteem and self efficacy, the coping methods which the client uses to cope will obviously affect his adjustment to HIV diagnosis.

1.18.2. COPING METHODS

Different theorists have examined different ways of coping with stressful life events. Some theorists have emphasized traits within the individual (Allport, 1966) while other theorists have focused on situational determinants of individual reactions (Mischel, 1968).

Speilberger (1975) examined the interaction between situational and dispositional determinants in individual reactions to stressful events. Moos (1988) advocates using coping strategies and coping skills in order to deal with adaptive tasks, which are encounted during a crisis such as HIV diagnosis.

1.18.2.1. COPING STRATEGIES

One widely recognized theory of coping proposes that the person and environment are considered to have a "dynamic mutually reciprocal, bi-directional influence". According to this theory, coping is defined as the "person's cognitive and behavioral efforts to manage the internal and external demands of the person-environment transaction that is appraised as taxing or exceeding the person's resources" (Grummon, Rigby, Orr, Procidano & Reznikoff, 1994).

Grummon et al., (1994) & Moos (1988) have divided coping strategies into three categories namely:

- active - behavioral coping (attempting to master the situation).
- active - cognitive coping (a search for meaning in an event).
- avoidance - coping (efforts to avoid thinking about or behaving in direct response to the illness).

Research on coping responses in people with AIDS, has primarily compared active-positive coping responses to avoidance-coping and denial strategies. These studies found that the former coping style is associated with lower mood disturbances, whereas escape-avoidance coping correlated positively with depression, poor psychological adjustment and self-destructive behaviors, such as drug and alcohol abuse and suicidal behavior (Grummon et al., 1994).

In a study performed with homosexual men recently diagnosed with AIDS, it was found that men who primarily used avoidance coping methods experienced greater psychological distress than those who were active in orientation. Avoidance was related to greater depression, anxiety and lower self-esteem with active-behavioral coping being associated with better functioning on these measures (Ahmed, 1992).

Moos (1988) notes that avoidance coping results in more negative coping, because individuals who use avoidance coping have few social support networks. It seems then that active coping is more conducive to psychological adjustment, but that it is partly a function of the individual's support system.

1.18.2.2. COPING SKILLS

Not only is it important to be active in one's coping strategy but as Moos (1988) notes, one must also make use of certain coping skills in order to deal with the adaptive tasks related to diagnosis.

Moos (1988) advocated that coping skills be organized into three categories depending on their focus.

1.18.2.2.1. APPRAISAL- FOCUSED COPING

This entails an attempt to understand and to find a meaning in a crisis.

- Moos (1988) argues that coping involves modifying the meaning and gaining a sense of mastery or control over the situation.

- Moos (1988) argues that appraisal focused coping involves:
- A logical analysis of the situation which involves management through breaking down the crisis into smaller events. This may mean living one day at a time with HIV disease.

- Secondly, the need to cognitively redefine the situation in a more favorable way. This includes comparing oneself to other people who are less well off, perhaps in the later stages of the AIDS disease.
- According to Taylor (1983) one may use selective perception to minimize the adverse elements of one's situation. This can include construing only positive elements of HIV, such as believing it led to personal growth.

- Thirdly, one may cognitively deny or minimize the seriousness of the event. In doing so one is able to use defense mechanisms to avoid being overwhelmed by the crisis of HIV diagnosis.

1.18.2.2.2. PROBLEM-FOCUSED COPING

This involves taking control and actively trying to change one's situation.

- Firstly, one skill that may be used is that of seeking information and support. This coping skill is especially important for the HIV- positive individual in that it engenders a sense of control by allowing the individual to understand the demands that might be made by his illness and his possible alternative courses of action.

Related to seeking information is seeking support from friends and family, and HIV support groups.

- Secondly, Moos (1988) advocated taking problem solving action. This involves making plans, and carrying them out. Taking action can create a sense of competence.

- Thirdly, Moos (1988) advocates pursuing alternative rewards. He notes that this involves attempting to replace one's losses by creating new sources of satisfaction.

The HIV-sufferer may use this skill by redirecting his energy into community organizations and helping other individuals to deal with the crisis of HIV.

1.18.2.2.3. EMOTION- FOCUSED COPING

This involves efforts to manage the feelings provoked by the crisis and to maintain affective equilibrium.

- Moos (1988) notes, that this involves efforts to maintain hope and to control one's emotions. Moos (1988) contends that some individuals manage their feelings by using a strategy of "progressive desensitization", whereby they gradually expose themselves to the stressor.

The HIV sufferer may at first deny certain aspects of his condition, and as he becomes more accustomed to his condition he may become more involved in dealing with it.

- Secondly, the individual may manage his feelings through emotional discharge. This includes venting feelings of anger or despair (Moos, 1988).

An individual who has recently been diagnosed may engage in tension reducing strategies such as drinking and smoking more, or taking tranquilizers.

- The third type of emotion focused coping is that of resigned acceptance. This involves coming to terms with a situation and accepting it as it is.

Acceptance with regard to HIV status does not preclude problem solving activities, but it may help the individual to have a fatalistic attitude towards his death and to accept certain facts which he is unable to change.

1.19. THE INTERRELATIONSHIPS BETWEEN PSYCHOSOCIAL AND IMMUNOLOGICAL VARIABLES.

1.19.1. PSYCHONEUROIMMUNOLOGY.

The relationships among psychological processes the central nervous system and immune system functioning form the basis of the field of Psychoneuroimmunology.
The field is concerned primarily with identifying mediating mechanisms through which psychosocial factors associated with initiation, severity, and progression of certain diseases might plausibly be linked to the disease process (Mays et al., 1989 & Coates, Temoshok & Mandel, 1984).

Disciplines ranging from anatomy to psychology revealed the immune system to be the target of brain and endocrine signals. Findings also suggest that the immune system is active even in a bi-directional feedback loop. Today the immune system is no longer regarded as autonomous and scientists began to see the emergence of a new psychosomatic paradigm. So far, evidence for the mind-body interaction paradigm has been collected with regard to the role of nerve fibres in lymphatic tissues, the effects of brain lesions on the immune system, the interplay of neurotransmitters, hormones and immunotransmitters in a network of bi-directional feedback loops between the brain and the immune system , the effects of ontogeny, learning and conditioning on the development of the immune system, the impact of experimental and naturally occurring stressors on the immune system, the possible immune modulating effects of personality characteristics, life style and psychodynamic processes and the role of the immune system in disease (Kropiunigg, 1993).

1.19.2. RELATIONSHIPS BETWEEN PSYCHOSOCIAL STRESSORS IMMUNE FUNCTION AND HIV- SEROPOSITIVITY.

1.19.2.1. STRESS AND IMMUNITY IN HIV- SEROPOSITVE PATIENTS

There is increasing evidence that immune system functioning is altered in response to psychological stressors (Cohen, 1991). Psychological distress appears to have significant deleterious effects on immunocompetency. Natural killer (NK) cell activity is reduced during stressful commonplace events and in subjects who perceive themselves as lonelier (Kiecolt-Glaser, 1986).

Stress has also been associated with decreased helper T-lymphocyte counts. Immune functioning is impaired in those experiencing marital disruption and in those recently bereaved. Natural killer cell cytotoxicity has also been found to be lower in those with major depression and alcoholism. Psychological stress has also been correlated with modulation of interleukin-2 (Kiecolt-Glaser, 1986).

A study conducted by Antoni, Baggett, Ironson, LaPerriere, August, Klimas, Schneidermam and Fletcher (1991) examined the role of potential mediators on the immunomodulatory effects of the stressful anticipatory period prior to HIV serostatus notification. Subjects in this study showed significant elevations in plasma cortisol levels, as well as changes in affect and cognitive responses regardless of serostatus identification. HIV sero-negative and HIV sero-positive subjects revealed lower NK cell activity and decreased lymphocyte counts. HIV sero-positive patients also showed lower CD4 T lymphocyte and CD4: CD8 T-cell ratio counts.

Several important psychosocial stressors have also been associated with impaired immune functioning. These include environmental stressors, anticipation of stressful events, perceived loss of control and feelings of helplessness and restraint immobility. The experience of chronic environmental stressors characterized by a loss of personal control, resulted in increased reports of psychological distress, such as anxiety and depression. These distress reports were accompanied by elevated levels of urinary cate-cholamines and decreases in total T-lymphocytes, CD4+ cells, and macro-phages (Baum, McKinnon & Silvia, 1987).

Immune function was also found to be impaired in studies using similar paradigms, as evidenced by decreases in the CD4 : CD8- cell ratios and NK-cell cytotoxicity (Teshima, Sogawa, Kihara, Nagata, Ago & Nakagawa, 1987).

There is also evidence that objective events are related to larger immune changes than subjective self-reports of stress, and that stressor duration is important for some immune outcomes. It has also been noted that interpersonal events are related to different immune outcomes than nonsocial events (Herbert & Cohen, 1993).

Negative mood states such as anxiety and stress have further been found to increase the deterioration of NK cell activity and the CD4- T cell counts (Kiecolt-Glaser, 1984).

Antoni et al., (1990) demonstrated that the reduction of burdensome psychosocial stressors had a positive impact on immune system functioning and so support the findings that lower levels of stress are associated with higher levels of immune functioning. It has also been suggested by Antoni et al., (1990) that in the early stages of HIV- infection, immune system functioning can be influenced by biopsychosocial interventions to enhance, improve and accelerate the implementation of natural defense mechanisms. This type of intervention is seen to enhance the interaction between CD4 cells, monocytes, NK cells and B cells through increases in cytokine and lymphokine production.

In a pilot study undertaken by Wolff et al., (1996) it was shown that personal control over stressful situations in HIV positive persons reduced physiological responses that may otherwise have further negatively impacted the health of these patients.

Psychological control over stress evoking circumstances is based on evidence gathered, that perceived control is related to health promoting activity of CD4 helper cells. As these cells are essential elements in the role of immune functioning due to their action against pathogens, they have become a focal point in the development of cognitive strategies attempting to formulate treatment programs for HIV- patients, utilizing biological principles that are psychologically based.

1.19.2.2. MECHANISMS LINKING STRESS AND IMMUNITY: PHYSIOLOGY AND BEHAVIOR.

How might stressor exposure result in immune alteration?
Both neuroendocrine and behavioural mechanisms provide plausible explanations (O Leary, 1990, Herbert & Cohen, 1993 and Cohen & Williamson, 1991).
First, stress is associated with the activation of several neuroendocrine systems, including the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS). The activation of these two particular pathways results in elevated serum levels of cortisol and catecholamines (Chrousos & Gold, 1992).

Immune cells have receptors for these hormones, implying that they play a role in immune system modulation serum levels of cortisol, epinephrine and norepinephrine, and are also directly associated with various indicators of immunity (O Leary, 1990).
Recent evidence however suggests, that the SNS is associated with alterations in human immune function before the HPA axis has had enough time to respond with an increase in cortisol. Support for this view comes from two laboratory studies that find SNS associated immune alteration in the absence of changes in serum cortisol (Landmann, Muller & Perini, 1984 and Manuck, Cohen & Rabin, 1991).

It is also possible that other endocrine systems activated by stress play roles in altering immune responses following stressors exposure. These systems include prolactin, growth hormone and the opiods (Ader, 1991).

An alternative kind of pathway that could account for the relation between stress and immunity involves the association of stress with specific behaviors that modulate immune responses. Distressed persons sleep less, exercise less, have poorer diets, smoke more, and use alcohol and other drugs more often than nondistressed people. These behaviors have all been shown to alter immune response (Herbert & Cohen, 1993). The association of stressor exposure with immunity might therefore, be accounted for by the health practices of stressed subjects.

1.19.2.3. DEPRESSION AND IMMUNITY IN HIV- SEROPOSITIVE PATIENTS.

There are two major effects on the immune system in HIV disease, inappropriate stimulation and depression. Inappropriate stimulation results in lymphadenopathy, increased CD8+ cells, increased serum IgG, IgA, b2, and microglobulin (Robertson, Wilkins, Handy, Van der Horst, Robertson, Fryer, Evans & Hall, 1993).
Depression, results in CD4+ cell depletion, decreased lymphokine production, decreased monocyte functions, and decreased natural killer cell cytotoxicity. The two mechanisms are related with increased activation, and there is further immune depletion which may result in a "vicious cycle" of events.

Thus, the presence of HIV may lead to stimulation of the immune system with the release of a variety of active substances such as lymphokines, which in turn stimulate CD4+ cells which then produce and shed virus. This further stimulates the immune system. At the same time, the increased HIV replication leads to CD4+ cell death through syncytia formation and membrane disruption. CD4+ cell depletion would then lead to further opportunistic infections, further immune stimulation, HIV replication and increased viral load with subsequent depletion of CD4+ cells, eventually leading to the onset of AIDS and death (Solomon, Kemeny and Temoshok, 1991).

Rabkin, Williamson & Remier (1991) found a suggestive pattern of association between depression, distress and the number of HIV related symptoms.

Kemeny, Weiner & Taylor (1994) found that depressed mood was significantly correlated with immune markers of HIV progression. In addition, the above authors found that depressed HIV-seropositive subjects had steeper declined in CD4+ cell counts over a two year period when compared to non depressed HIV seropositive individuals.

Schneiderman (1992) indicated that the incidence of DSM-III-Axis I affective and adjustment disorders and sustained distress levels are high throughout HIV- infection, of which adjustment disorder with depressed mood is the most common.

Namir (1987) reported that 81% of HIV respondents expressed an interest in individual or group psychological interventions.

Moreover, the suicide rate among HIV- infected individuals may be up to 36 times that of age-matched uninfected individuals supporting the view that depression is a common sequelae of an HIV- diagnosis. Finally, the co-existence of a feeling of life-threat, doom, anger, and responsibility for making immediate lifestyle changes following a seropositive diagnosis suggests that interventions which provide social support, teach active and adaptive coping strategies, foster and encourage implementation of positive lifestyle changes, and offer the opportunity for mastery experiences may be beneficial (Schneiderman, 1992).

Such interventions may also help individuals ventilate feelings such as anger and depression and manage anticipatory grief over the expectation of loss and death (Schneiderman, 1992).

Another important aspect of depression, is that it commonly occurs in conjunction with chronic medical illness (Rodin, 1991). Depression is reported in as many as 48% of those newly diagnosed HIV seropositives and 83% of those hospitalized with AIDS (Perry, 1984).

A recent meta-analysis of studies of depression and immunity supported an association between depression and CD4+T lymphocyte, CD8+T lymphocyte, and natural killer cell numbers, and CD4 +: CD8+T cell ratios (Herbert & Cohen, 1993). However, studies examining the relationship between immunosuppression and depression in persons with HIV were not consistent in their findings. Some investigators reported a strong association between CD4+ T lymphocyte counts and depression (Kemeny et al., 1994) and subjects with a more rapid decline in CD4+T cell counts were chronically depressed (Lyketsos, Hoover & Guccione, 1993 & Kemeny et al., 1994). Depressed persons with HIV were also reported to have lower CD4+T cell counts than those who were not depressed (Lyketsos et al., 1993).

Conversely, other studies suggested that depression was not related to cellular immunity in persons with HIV. Lower depression scores were reported in persons with AIDS, who typically have the lowest CD4+T lymphocyte counts, than in those with ARC (Tross & Hirsch, 1988). It was further reported that at-risk seronegative subjects had higher depression scores than subjects with ARC (Ostrow, Monjan & Joseph, 1989).

These disparate findings can be explained if one considers that no single factor can be used to explain complex psychobiological relationships. Symptoms of depression can be the result of immunosuppression in this population. However, additional psychological and behavioural factors are salient for the individual anticipating seroconversion or progression from one disease stage to another. For example, it has been suggested that higher levels of uncertainty, lack of control, and hopelessness regarding disease progression in earlier stages of infection produce greater psychological distress (Kelly & Murphy, 1992 & Miller, 1990).

1.19.2.4 PHYSIOLOGICAL FATIGUE AND IMMUNITY IN HIV-SEROPOSITIVE PATIENTS.

Fatigue is associated with HIV from early-stage acute infection through late-stage AIDS. It increases in severity with disease progression and impairs the individual's ability to perform normal daily activities (Fox, 1987, Longo, Spross & Locke, 1990 & Williams & Lubeck, 1993). Fatigue was reported in 17% of persons with early-stage HIV and 11% to 28% of persons with AIDS-related complex (ARC), and 56% of persons with AIDS. It is the principal symptoms that leads persons with HIV to become unemployed (Williams & Lubeck, 1993).

In a study conducted by Doob & Macfadden (1992) reduction in fatigue was strongly correlated with improved quality-of-life in their HIV-seropositive population.

Data from the Multicenter AIDS Cohort Study supported a relationship between immunosupression, particularly decreased CD4+T lymphocyte count, and fatigue in persons with HIV (Eller, 1995).

In other studies CD4+T cell count was inversely correlated with incidence and severity of self-reported fatigue, and fatigue was shown to be responsive to treatments that increased the CD4+T lymphocyte count in persons with HIV (Eller, 1995).

In a pilot study undertaken by Wolff et al., (1996) a combined aerobic exercise and cognitive-behavioral intervention led to increases in the vigor-activity level of HIV-seropositive patients, which had as a result decreases in the levels of fatigue and improvements in T-lymphocyte subsets. More specifically, increases in CD4 T-cells were observed, and although these increases were not statistically significant, they were clinically significant. Taken together the above studies provide support for the assumption that symptoms of fatigue can be the result of immunosuppression in persons with HIV, and that decreases in fatigue are related to immune enhancement

1.20. THE NEUROPSYCHOLOGY OF HIV INFECTION AND AIDS.

Infection by the HIV causes both systemic and neuropsychiatric disease. Progressive depletion of especially the CD4 T helper\ inducer cells leaves the infected person vulnerable to opportunistic infections and neoplasms characteristic of AIDS.
A second major consequence of HIV infection involves progressive central nervous system (CNS) dysfunction, which can culminate in a pattern of diffuse impairment, known as the AIDS dementia complex (Newton, Leuchter, Walter, Van Gorp, Morgenstern, Miller, Lieb, Visscher, Satz & Weiner, 1993). By the final phase of illness, approximately two thirds of all people with AIDS manifest this pattern. An additional quarter manifest more limited symptoms. Furthermore, at autopsy, neuropathological evidence of CNS disease has been detected in 78 % of HIV patients brains studied (Newton et al., 1993 & Tross, 1990)

1.20.1. CLINICAL DESCRIPTION OF AIDS DEMENTIA COMPLEX (ADC).

In its early course, ADC is especially marked by cognitive symptoms, particularly mental slowing and deficits in recent memory and attention, which are manifested by the majority of patients. At the same time, approximately one half of these patients present with motor symptoms in the form of increased apathy and withdrawal. Neurological signs, detected by examination, are relatively limited to slowing and blunted affect, gait problems, ataxia and hyperreflexia, especially in the lower extremities, is also present (Grant & Heaton, 1990 & Tross, 1990).

Once clinical manifestations are evident. the CNS disease tends to progress rapidly with frank dementia becoming apparent within 6-12 months in many cases, although considerably longer time courses have been recorded (Grant & Heaton, 1990).
In its later course, ADC may resemble a full-blown, incapacitating geriatric-like dementia. Slowing, in both the verbal and motor nodes, has been detected in patients.

At this stage, motor symptoms that are common, include: ataxia, hypertonia, incontinence, tremor, frontal release signs and weakness, especially of the lower extremities (Bor & Miller, 1988 & Grant & Heaton, 1990).

1.20.2. HIV ETIOLOGY OF AIDS DEMENTIA COMPLEX (ADC).

The causal role of HIV brain infection in these neurological complications is well documented. HIV, has been detected in the brains and Cerebrospinalfluid (CSF) of persons with AIDS, with neurological complications, and in the CSF of people with earlier forms of HIV disease. HIV has also been isolated from the CSF of people at intermediate stages of HIV disease, including AIDS-related complex and aseptic meningitis immediately following seroconversion from the sural nerve of a person with peripheral neuropathy and from the spinal cord of a patient with vacuolar myelopathy (Grant & Heaton, 1990 & Tross, 1990).

HIV has also been isolated from the CSF of asymptomatic HIV seropositive individuals, especially, but not solely, if they had neuropsychiatric symptoms (Tross, 1990). Shaw et al., (1985) in Tross (1990) found even higher concentrations of HIV in the brain than in the lymph nodes, peripheral blood or bone marrow.

1.20.3. NEUROPSYCHOLOGICAL IMPAIRMENT IN ASYMPTOMATIC HIV INFECTION

Clearly, HIV brain infection is a necessary condition for the development of AIDS Dementia Complex. However, it is not clear whether it is a sufficient condition for the development of neuropsychological defects in otherwise asymptomatic HIV seropositive individuals (Bor & Miller, 1988 & Grant & Heaton, 1990). At this point in time, there is conflicting evidence of both the presence and absence of cognitive impairment in asymptomatic individuals. However, there is also a substantive basis for the lack of conclusive results.

Navia et al., (1986) in Tross (1990) found that their ADC patient group could be differentiated from their nondemented patient group by their longer duration of AIDS diagnosis, their higher frequency of infection with mycobacterium avium intracellular (MAI) and cytomegalovirus (CMV), and their lower frequency of diagnosis with Kaposi's sarcoma in the absence of a concomitant opportunistic infection. They suggested that these findings may be seen as evidence that the setting of significant immunodeficiency, as marked by the presence of opportunistic infection, is required for the development of ADC. They have recently concluded that "although this virus is 'neurotropic,' it is relatively nonpathogenic for the brain in the absence of immunosuppression".

1.21. THE BIOPSYCHOSOCIAL MODEL OF HIV\ AIDS MANAGEMENT AS AN ADJUNCT TO THE PRESENT MEDICO-PHARMACOLOGICAL TREATMENTS

Early research on HIV and AIDS had a primarily biomedical orientation and the management of the disease was concerned primarily with pathological and medical symptoms due to the urgency of finding a vaccine for the virus. It was only since 1984 that consideration was accorded to a more extensive biopsychosocial model for treating persons infected with HIV (Schlebusch & Cassidy, 1995).

George Engel has been the most prominent proponent of the biopsychosocial model of disease, which stresses an integrated systems approach to human behavior, and recognizes that most medical (and psychological disorders) are more complex and multi-faceted than has been argued by the earlier reductionistic disease models, and proposes an integration of biological, psychological and sociocultural factors in health care (Schlebusch & Cassidy, 1995 & Kaplan et al., 1994).

The biological system emphasizes the anatomical, structural, and molecular substrate of disease and its effects on the patients biological functioning; the psychological system emphasizes the effects of psychodynamic factors, motivation, and personality on the experience of illness and the reaction to it; and the sociocultural system emphasizes cultural, environmental, and familial influences on the expression and the experiences of illness (Kaplan et al., 1994).

Engels model does not assert that medical illness is a direct result of a persons psychological or sociocultural makeup but, rather, encourages a comprehensive understanding of disease and treatment (Kaplan et al., 1994).

Current research in the area of HIV\ AIDS, that is occurring within a biopsychosocial framework, and which incorporates the insights from the various sub-disciplines of psychology, has been assessing the role of psychosocial stress, social support, and emotional adjustment of HIV-seropositives. This research, has given considerable weight to the argument that psychosocial stress is associated with emotional adjustment, and that social support is a significant factor in facilitating the psychological adjustment of persons with HIV\ AIDS (Schlebusch & Cassidy, 1995). Turning to consider the South-African context, similar psychosocial issues and sequelae to those cited in international literature have been identified in South-Africans with HIV\ AIDS (Livingstone, 1988, Cassidy & Schlebusch, 1993 & Schlebusch & Cassidy, 1995).

Biopsychosocial researchers have further reasoned, that if psychological distress such as anxiety, depression and stress can interfere with proper immune functioning, it may than also interfere with the host defenses in persons infected with the HIV, and further suppress an already compromised immune system. Biopsychosocial treatment interventions should therefore, be indicated for these individuals in order to avoid any further deterioration of their health status (Weisse, 1992 & Kiecolt-Glaser & Glaser, 1992)

Bor and Miller (1988) stress the importance of psychosocial treatments for HIV/AIDS-sufferers. Their motivations involve three main assumptions.

Firstly, most HIV / AIDS-sufferers will inevitably or invariably experience psychological or social difficulties which may emerge at varied stages along the infectious continuum. Secondly, as with any ongoing debilitating illness, medical or physical problems have implications for the individuals relationship as well as the individuals view of him or herself.

Finally, the authors conclude that care-givers should be aware that illness affects people in different ways, and it is important to identify the meaning each individual attaches to the disease. However, it should be noted that due to the unpredictability and complexity of the HIV/AIDS-continuum, it is often difficult to provide permanent solutions.

1.21.1 COGNITIVE BEHAVIORAL THERAPY - EMG BIOFEEDBACK AND AEROBIC ACTIVITY AS ADJUNCTIVE TREATMENT METHODS TO THE PRESENT MEDICO-PHARMACOLOGICAL TREATMENTS: A BIOPSYCHOSOCIAL PERSPECTIVE.

INTRODUCTION

The existing health psychology literature regarding the treatment of HIV-seropositivity and AIDS, would seem to indicate that a dire need exists for the development of effective adjunctive treatment methods to the presently available medico-pharmacological treatments. Herein, biopsychosocial treatment methods, especially when used during the asymptomatic and early symptomatic stages of HIV- infection, have been shown to be somewhat more successful then the presently available retroviral agents (Antoni et al., 1990, LaPerriere et al., 1990 & Wolff et al., 1996). Biopsychosocial interventions also appear to forestall, or even eliminate the onset of disease complications, such as opportunistic infections and neoplasia associated with the later clinical AIDS stages, and they appear to be doing so without any recorded side-effects (Weisse, 1992 & Wolff et al., 1996).

Further research revealed that the earlier the stage of HIV infection, the greater the psychological distress experienced, with the asymptomatic stage showing the highest levels of distress (Lindegger & Wood, 1995). This is probably a function of the anxiety and fear surrounding the uncertainty of the implications of being HIV-seropositive.
In addition to the above findings, active coping approaches have generally been shown to be more effective than passive (avoidant) approaches to coping with HIV infection and AIDS (Antoni et al., 1990 and Lindegger & Wood, 1995).

With the development of more effective medications for the later clinical stages of HIV infection, there is now a fast-growing population of asymptomatic and early symptomatic (pre-AIDS) individuals who are having to cope with the complex and multiple psychosocial demands of a chronic life threatening disease (Schneiderman, 1992 and Kaplan, Sadock & Grebb, 1994). These men and women, in addition to the direct burdens of the HIV infection, are likely to experience several uncontrollable stressors, and social isolation. Asymptomatic and early symptomatic HIV infected individuals report an overwhelming sense of uncertainty and some problems with available coping strategies for dealing with HIV infection (Schneiderman, 1992).
This could result in a lack of effective active coping styles and resources needed to deal with the physical and psychological concomitants of HIV infection.

The use of cognitive-behavioral therapy, especially when combined with aerobic activity has been demonstrably useful with HIV-seropositive patients during the asymptomatic and early symptomatic stages of the disease (Antoni et al., 1990 & Wolff et al., 1996).
More specifically, studies completed by Antoni et al., (1990) and Wolff et al., (1996) demonstrated that cognitive-behavioral therapy in combination with aerobic activity can be used as a stress buffering technique resulting in positive lifestyle changes amongst asymptomatic and early symptomatic HIV-seropositives. Cognitive behavioral interventions have further been found to produce improvements in psychological and physiological functioning.

These interventions have been shown to buffer post-notification depression levels, decrease levels of anxiety and emotional distress and increase NK cell activity and CD-4 / T-lymphocyte cell counts in HIV-seropositive persons (Antoni et al., 1990). They have further been found to retard disease progression in asymptomatic HIV-seropositives (Antoni et al., 1990). Studies utilizing aerobic exercise as behavioral treatment methods, have also demonstrated positive effects on immunologic and physiological indices and psychological status of HIV-seropositive persons. More specifically, LaPerriere et al., (1990) reported that physical activity is related to survival time for those infected with the AIDS virus, the study further revealed that an increase in aerobic fitness is accompanied by potentially beneficial increases in T-lymphocyte subsets among HIV seropositive individuals.

Further research in other applications of health psychology interventions, indicated Electromyographic (EMG)-biofeedback as a very effective relaxation method, especially when used in conjunction with cognitive-behavioral therapy in addressing the psychobiological aspects of disease (Kiecolt-Glaser & Glaser, 1992). Various studies have shown that EMG biofeedback-assisted relaxation training can effectively reduce tension in the frontalis muscle of the forehead, and concluded that this muscle relaxation should generalize to other muscle groups (Schwartz & Beatty, 1977 & Schwartz & associates, 1987). It would then also appear possible, that EMG-biofeedback could be used as an effective adjunctive form of treatment in asymptomatic and early symptomatic HIV-seropositives. During these early stages of HIV infection, the anxiety and physiological tension surrounding the uncertainty of the implications of being HIV-seropositive is immense. Physiological manifestations of anxiety or physiological tension can be reduced by teaching the patient to be aware of the physiological differences between tension and relaxation, and learn how to control each physiological state effectively.

In the section that follows, further literature regarding each of the three procedures is discussed, and literature is cited regarding the effectiveness of each treatment modality within a biopsychosocial framework.

1.21.1.1. COGNITIVE-BEHAVIORAL THERAPY.

Considerable medical and biopsychosocial research has been undertaken since the discovery of the Human immunodeficiency-virus and AIDS. More specifically, biopsychosocial researchers have examined various methods to assist HIV-seropositve sufferers in coming to terms with their infection, decrease their levels of anxiety and depression, and provide information regarding their relatively uncertain disease progression.

Cognitive-behavioral interventions and social-support therapeutic strategies are considered to be two of the most widely used approaches by biopsychosocial clinicians and researchers (Kelly et al., 1993).

Behavioral interventions usually combine a number of techniques into a package which would include relaxation skills training, assertiveness training, cognitive restructuring techniques and instruction on the self monitoring of environmental stressors (Antoni et al., 1991). Coping consists of cognitive and behavioral efforts to manage specific internal or external demands that are perceived as exceeding the personal resources of the individual (Nicholson & Long, 1990) once this is achieved, individuals will be more likely to assert control over their environment and circumstances.

The rationale for using a cognitive-behavioral intervention lies in its practical approach and effective nature to cause behavioural change and psychological modification. Psychological states can be modified in HIV- seropositive patients to facilitate increased self-efficacy; perceived control over life-stressors, increased satisfaction and use of social support; employment of active coping strategies to deal with problems, and finally through these modifications reduce harmful biological and psychological effects of acute and chronic stressors (Antoni et al., 1991).

Cognitive-behavioral interventions have further been shown to buffer post-notification depression levels, decrease levels of anxiety and emotional distress and to increase Natural-Killer (NK) cell activity and CD4 T-lymphocyte cell counts (Antoni et al., 1990). Weisse (1992) further alleges that cognitive-behavioral therapy has been shown to be as effective as pharmacotherapy, an advantage being that it does not interfere with immunologic processes. Controlled research evaluating cognitive-behavioral therapy and social support therapy among depressed HIV positive men, showed that participants in both interventions showed greater reductions of depression and other measures of emotions than control groups.

Cognitive-behavioral therapy is much commended and admired because of its extremely beneficial and powerful function to facilitate change in patients. The strength that this form of therapy has, is in part, due to the clear, overt statements of goals which are desired to be achieved, giving the patient and therapist definite aims and thus minimizing false hopes. The mechanisms that are used for achieving these goals, are quite concrete and allow patients to witness any progress that they make, making the therapeutic experience a fruitful life experience with practical benefits (Aveline, 1992)

The cornerstone of Cognitive-behavioral models is the assumption that individuals interpretation of events can have an important influence on their emotional state and behavior. Though there are divergence's amongst cognitive-behavioral models, there is a consensus that thought processes, emotions, and behavior are interdependent (Scott, 1989). Cognitive-behavioral therapy is based on the rationale that an individuals affect and behaviors are largely determined by the way in which they structure their world based on cognition's, which are furthermore based on personal assumptions developed from previous experiences (Kaplan, Saddock & Grebb, 1994). Each person should be seen as unique with very specific needs, hopes and meanings that form the basis of their therapeutic process. Important aspects that deal directly with the physical orientation and adaptation to an HIV diagnosis are, reducing stress through coping mechanisms, enhancement of health promoting behaviors and encouragement of active change (Hoffman, 1991).

Cognitive methods are most often used to empower persons who do not possess natural coping mechanisms, and are thus not able to deal with stressful situations which exceed their capabilities. This type of therapy is seen to hold the greatest potential for lowering levels of stress or discomfort, as it provides patients with information and deals more directly with psychosocial issues related to HIV infection and the AIDS disease, as well as management of psychological and social factors. Information about existing supportive organizations and medical services is also provided, so that patients may gain a sense of security and control over their situations, knowing that medical services and help are available if and when needed.

1.21.1.2. BIOFEEDBACK- RELAXATION TRAINING.

INTRODUCTION

"Biofeedback,"is a term that refers to a group of procedures in which an external sensor is used to provide the organism with an indication of the state of a bodily process, usually in an attempt to effect a change in the measured quantity (Schwartz & Beatty, 1977 and Danskin & Crow, 1981). "Biofeedback Training" consists of the detection of an electrical signal generated by some bodily tissue. This signal is amplified and then used to trigger a visual or auditory display, thus providing the subject with continuos information as to his progress in controlling the signal. In other words, the subject is connected in a feedback loop with some physiological response he himself is generating. Through such " mirroring" of his own physiological activity, he is enabled to "hear" or "see" his own alpha, theta or EMG activity and therefore train himself to voluntarily control his own physiological or psychophysiological state (Danskin & Crow, 1981 & Miller, 1989). The goal of biofeedback training is to achieve voluntary self- regulation of bodily processes without the use of the feedback instruments.

1.21.1.2.1. THE VALUE OF BIOFEEDBACK AS A SCIENTIFIC RESEARCH TOOL

Biofeedback represents a scientific tool both for manipulating and thereby, studying physiological and psychophysiological processes. Historically, biofeedback grew out of the behavioristic traditions of operant or instrumental learning paradigms, coupled with the evolving paradigms of feedback in cybernetics and systems analysis. More specifically, biofeedback is based on the concept that autonomic nervous system responses can be controlled through the process of operant conditioning (Schwartz & Beatty, 1977 & Kaplan, Sadock & Grebb, 1994). A unique feature of the operant-feedback procedure as a tool for scientific investigations is its capability to generate highly specific changes between and within different physiological systems. By examining the effects of such changes, it is possible to explore relationships between, different physiological systems in the intact organism, and complex behavioral responses and their underlying biological substrates. Physiological manifestations of anxiety or physiological tension can also be reduced by teaching the patient to be aware of the physiological differences between tension and relaxation. The teaching involves immediate feedback to the patient through concrete, visible or audible recordings of the patients biological functioning during anxiety versus relaxation states. The procedure reinforces the patients awareness of which state is present and helps the patient learn how to control it (Shapiro & Schwartz, 1972, Schwartz & Beatty, 1977 and Kaplan, Sadock & Grebb, 1994).

In this respect, biofeedback can be viewed as a powerful research tool, not in the sense of necessarily producing large magnitude changes, but rather as a means of gaining experimental manipulation over specific physiological processes so as to explore the nature of their relationships with other such processes and their association with specific environmental and behavioral conditions. It is this aspect of biofeedback that qualifies it as an adequate scientific research method for studying problems relating biology and behavior.

1.21.1.2.2 METHODS USED IN BIOFEEDBACK -TRAINING.

Biofeedback rests on cues we can learn to control i.e physiological muscle tension, skin temperature or the amount of sweat we excrete are some such examples. Biofeedback, through the use of specifically formulated instruments makes possible the detection of these cues, and by combining the two fields of psychophysiology and behavior modification, voluntary self-regulation of psychophysiological states is achieved during biofeedback training (Miller, 1989).

The most effective instruments used in biofeedback training are firstly, the electromyogram (EMG), which measures the electrical potentials of muscle fibers.
In Electromyographic biofeedback, an electrode picks up the signal produced by microelectric pulses between nerve endings and muscle fibers. Since the amount of stimulation a muscle gets from a nerve controls how much it contracts, EMG feedback indicates the general state of contraction versus relaxation in a particular muscle group. This reading is translated into an auditory or visual tone. As the patient learns to lower the tones volume or frequency, he begins to simultaneously reduce the physiological tension in his muscles. EMG biofeedback, is normally an effective form of therapy in treating physiological states of tension, pain syndromes that involve chronically taut muscles and could also serve as an adjunctive treatment method to pharmacotherapy, especially for HIV sero-positive patients (Miller, 1989 & Kaplan, Sadock & Grebb, 1994).

The second method of biofeedback, known as Temperature biofeedback, makes use of a thermistor, measuring skin temperature, which drops during tension because of peripheral vasoconstriction. The thermistor is normally placed on the affected area, usually the hands or feet. This technique, is normally used in helping to relieve migraine headaches by easing tension in constricted arteries. It has also been found to be an effective means of therapy for Raynauds disease, which involves painful cycles of blanching and reddening in the hands (Gatchel & Price, 1979 & Miller, 1989).

Electrodermal biofeedback, also known as galvanic skin response (GSR), uses a probe that responds to sweat or perspiration. Since the chemical composition of perspiration makes it a good electrical conductor, more sweat production by the sweat glands means better contact and a stronger signal. Most people tend to sweat more under states of arousal and stress, and show decreased skin conductivity during a relaxed state.
Electrodermal feedback, is an effective form of therapy for physiological tension and anxiety reduction, chronic stress and chronic pain (Miller, 1989 & Kaplan, Sadock & Grebb, 1994).

1.21.2 CLINICAL-THERAPEUTIC APPLICATIONS OF ELECTROMYOGRAPHIC BIOFEEDBACK-ASSISTED RELAXATION TRAINING.

1.21.2.1. INTRODUCTION

Electromyographic (EMG) biofeedback-assisted relaxation as treatment in tension and anxiety disorders has become rapidly accepted as a therapeutic alternative to medication. The rationale for using EMG biofeedback is based on the idea that if the autonomically mediated physiological arousal associated with anxiety can be reduced or controlled, the motor and behavioral manifestations as well as subjective reports may subsequently decrease (Rice & Blanchard, 1982).

EMG biofeedback is one of the more useful forms of feedback for training low arousal patterns, as it involves some voluntary as well as involuntary control, and thus learning accrues at a faster rate than with the training of completely involuntary responses. Moreover, the skeletal muscle system comprises a large percentage of the entire bodily mass and therefore a change in this system can, and usually does, produce changes in other systems, such as the central nervous system (CNS) and the autonomic nervous system (ANS). Through the continuos feedback of the EMG, the trainee develops first an awareness of, and then control over the level of that muscle tension.

Eventually, the patient is able to generalize that control to other skeletal muscles and thereby affect, indirectly, autonomic and cortical functioning.
Finally, the patient is trained to transfer this control to everyday life situations outside the clinic or laboratory (Budzynski, 1973 & Budzynski, 1977).

Cognitive factors have been suggested, as being influential in teaching a person to focus attention on relaxing muscles and away from the stress associated with tension. They have implied that cognitive control may alter emotional arousal and facilitate coping. The idea is that successful EMG training can help a person call upon relaxation skills to help counteract the arousal and physiological reactions to stress and tension while enhancing an individual's belief of self mastery and competence (Weinman, Semchuk, Gaebe & Mathew, 1983).

1.21.2.2. EMG BIOFEEDBACK- ASSISTED RELAXATION TRAINING : PSYCHOLOGICAL STATES AND IMMUNITY.

Biofeedback-assisted relaxation has been shown to be an effective means of eliminating symptoms related to both psychological stress and physical disorders (Basmajian, 1979 & Peavey, Lawlis, Goven, 1985 & Kaplan, Sadock & Grebb, 1994). It is not clear whether the beneficial effects of relaxation are due to reduced arousal levels, as suggested by Schwartz & Beatty (1977) and / or to a decrease in sympathetic activity, within the autonomic nervous system (Benson, 1983).

Several studies have nonetheless, correlated relaxation with specific changes in immune system parameters. In one such study, Peavey et al., (1985) found that phagocytic cells from subjects who reported a higher degree of stress had reduced activity in contrast to those with low stress levels. High stress individuals were also found to have reduced anxiety and improved coping ability following the biofeedback training (Gruber, Hersh, Hall, Waletzky, Kunz, Carpenter, Kverno & Weiss, 1993).

In a study conducted by Gruber, Hall, Hersch and Dubois (1988) metastatic cancer patients taking part in biofeedback-assisted relaxation showed significant elevations in measures of immune function when compared to base line levels (Halley, 1991). Furthermore, psychological measures that changed included increased aggression and internal locus of control. Some individuals who showed the largest drops in EMG levels had the largest increases in immune function when biofeedback training was given after seven months of relaxation training (Halley, 1991).

In a study conducted by Peavey, Lawlis, & Goven (1985) male and female subjects were divided on the basis of their scores on a stress scale. Under baseline conditions, it was found that phagocytic cells from those who reported a high degree of stress had reduced activity in contrast to those with low stress. In a subsequent component of that study, it was found that those individuals who measured high on the stress scale benefited more relative to the low-stress group following biofeedback training as expressed by increased measures of phagocytic activity. These high-stress individuals were also found to have reduced anxiety and improved coping ability following the biofeedback training.

Jasnoski and Kugler (1987) correlated salivary IgA responses with relaxation either alone or in concert with guided imagery. While no differences in IgA were found between the relaxation and the relaxation plus imagery group, the presence of the relaxation component did correlate with elevated levels of IgA compared with control subjects who were included to control for alertness or mild arousal.

In a study undertaken by Townsend, House, and Addario (1975) EMG-training was reported to be superior to group therapy, and Canter, Kondo, and Knott (1975) found EMG-training superior to progressive relaxation (Gatchel & Price, 1979)

Thus it appears from the above literature that EMG biofeedback- training produces therapeutic benefits above and beyond that which is effected by traditional therapy and progressive muscle relaxation.

Lavallee, Lamontangne, Pinard, Annable, and Tetreault (1977) compared EMG, diazepam and a control condition and found EMG best right after treatment, but not at follow-up. Kappes and Michaud in a study undertaken in (1978) further showed that contingent feedback produced lower EMG readings and test anxiety scores.

In summary, it is clear from the above studies that EMG biofeedback can serve as an effective form of therapy, not only in reducing purely negative psychological states, but also in stimulating immune function. In this regard, the use of EMG biofeedback is strongly supported and HIV-seropositive patients could have a form of active therapy, adjunctive to the present passive form of medical treatment.

1.21.1.3 AEROBIC EXERCISE - PHYSICAL ACTIVITY

1.21.1.3.1. INTRODUCTION

Increases in physical fitness are often associated with improvements in health status and disease prevention (LaPerriere et al., 1990). It is a well established fact, that an aerobic exercise program performed on a routine basis, improves functioning of the cardiovascular system and is inversely related to coronary heart disease, strokes, diabetes and obesity (Leon, 1985 in La Perriere et al., 1990 & Lewis, Sperry & Carlson, 1993).

Recent evidence has also linked aerobic exercise to enhancement of the immune system and reduced risk for cancer. Temoshok et al., (1987) in LaPerriere et al., (1990) reported that physical activity is related to survival time for those infected with the AIDS virus, and the aerobic exercise intervention completed by LaPerriere et al., (1990) revealed that an increase in aerobic fitness is accompanied by potentially beneficial increases in T-lymphocyte subsets among HIV-1 seropositive individuals.

Aerobic exercise programs have also been found to enhance both cellular and humoral immune functioning, along with reducing emotional distress, producing immunomodulatory effects and have been associated with enhanced immune functioning as well as retarding of HIV-1 disease progression, in HIV-seropositive patients (Antoni et al., 1990).

Exercise can therefore be seen in a therapeutic sense to take on a very important facet and function in health promotion and disease prevention that will be used more frequently in the future, especially in the field of health psychology, relating behavioral modifications to physical disorders (Lewis et al., 1993 & Sharkey, 1990).

1.21.1.3.2. PHYSICAL ACTIVITY AS A BEHAVIORAL INTERVENTION.

When physical activity is used as a behavioural intervention, it must focus and be tailored to achieve the function it was designed for. Due to the fact that different types of exercises effect the body in different ways, swimming, for example improves cardiovascular fitness, endurance and muscle strength, compared to weight lifting which will only improve muscle strength, it is important to consider the above aspects, when, required to develop and construct programs for clients that utilize behavioural and motivational aspects to initiate and maintain physically active and healthy life-styles.

For participants to benefit from an aerobics exercise program, they must be subjected to a load greater than the load to which they were accustomed to. At the beginning of an exercise program, participants are deconditioned from sedentary life-styles due to little or no exercise in the past, and this is normally enough to create a strain and therefore a physical effect. As the participants fitness levels improve, a greater duration and intensity of exercise will be needed to create strain and produce change.

To benefit and progress from exercise, a program should be gradually applied to avoid excessive strain. At the beginning of an exercise program the rate of progress should be relatively slow as sudden changes in physical activity can cause muscle soreness and injury to muscles that are unaccustomed to stress and strain of vigorous exercise.
To keep the interest and enthusiasm of participants, training should be designed so that participants experience minimum discomfort and muscle soreness. To enable this, an individual-specific program should be developed and tailored to meet the needs of each participant (Ryan, 1983 & Sharkey, 1990).

In summary, factors that must be taken into account for the accurate and specific development of an exercise program include the type or mode of exercise, frequency, intensity, and duration (Lewis et al., 1993).

1.21.1.3.3. COGNITIVE STRATEGIES AND EXERCISE ADHERENCE.

Adherence to exercise is often mistakenly seen to be a natural result of health education, and that motivation is provided by improved performance and fitness.
However, fitness improvement and health education are inevitable by-products of exercise programs which ensure long-term adherence (Lewis et al., 1993).

Cognitive strategies can also be used to increase adherence to an exercise program and several factors have been found to facilitate this. Personal factors such as low self-motivation and self-efficacy have been found to correlate highly with dropout rates of participants. Disillusionment of progress, which often stems from participants interpreting slow progress as failure of achieving the goals that they set, has also been found to reduce adherence to exercise program's.

Biological factors such as overweight, have generally been associated with a sedentary life-style related to listlessness, low motivation and bad eating habits. Sedentary life-style is related to low exercise adherence and a high dropout rate.

Social-environmental factors are often also found to predict exercise program adherence well, because they are directly related to the influence a participant has out of their family or immediate social support network. Intra-family stability and the absence of family problems relates positively with exercise adherence.

Group participation during exercise has also been found to encourage participation as motivation is easily lost when exercise is done alone (Wolff et al, 1996).

Finally, convenience of the location of the exercise facility and whether the participants are finding pleasure in this physical activity, as well as the social-support network established at this facility, will determine adherence to exercise (Lewis et al., 1993).

1.21.1.3.4. BIOCHEMICAL ASPECTS OF EXERCISE.

Exercise analyzed from a bio-chemical perspective, is shown to demand certain resources from the body systems, due to increased muscular activity, bringing about increased needs of energy demanded by the muscle cells. As the metabolic rate is increased through the use of available metabolic substances including muscle glycogen and fat, blood glucose and free fatty acids are transported through the blood from fat stores to the working muscles. To maintain the increase in the metabolic activity, oxygen has to be provided to the working muscle or fatigue will set in. The increased metabolic rate via the muscle functioning necessitates the transportation of substrates and oxygen to the muscle tissue and the removal of metabolic waste products, which in turn produces a variety of adaptive responses in the body (Lewis et al., 1993 & Johnsgard, 1989). The central nervous system adapts proportionally, to the intensity of the exercise to facilitate the metabolic processes by reducing the parasympathetic tone and increasing the sympathetic nervous system drive.

These two systems act in opposition to one another to maintain and keep the equilibrium balance. During vigorous exercises the metabolic demands increase together with the blood flow to the various working muscles. These increases in metabolic demands and the blood flow are proportionate to meeting the bodies physiological demands and thus produce elevations in cardiac performance. The blood pressure also rises during exercise because the increase of blood flow results in a greater driving pressure, and thus the heart rate reflects the approximate amount of effort exerted in the exercise (Lewis et al., 1993).

1.21.1.3.5. EXERCISE AND MENTAL HEALTH.

Studies conducted have supported that mental health in both clinical and nonclinical populations is positively affected by regular vigorous physical activity. Psychological benefits which are gained from such activities are improved confidence, feelings of well-being, sexual satisfaction, anxiety reduction, moderation of symptoms of depression, and improved intellectual functioning (Lewis et al., 1993 & Sharkey, 1990).

Exercise can also be seen as an important preventive measure as it makes people less susceptible to factors that might produce mental illness. Findings have been made, that avid exercisers frequently report improved quality of life, increased sense of accomplishment, feelings of self-worth, well-being and relaxation. Feelings of relaxation, euphoria and elation throughout and afterward exercising, have also been reported and contribute to personal satisfaction (Lewis et al., 1993).

1.21.1.3.5.1. THE RELATIONSHIP BETWEEN EXERCISE- ANXIETY AND STRESS.

Exercise programs consisting of six weeks to twenty months of aerobic exercise training have produced increased perception of well-being and reduction in anxiety (LaPerriere et al., 1990). Morgan and colleagues have also shown that anxiety is reduced following an acute episode of physical activity (LaPerriere et al., 1990).

Increasing an individuals aerobic fitness level may provide one means for reducing the effects of unavoidable stress, thereby attenuating the stress-illness relationship.
In fact, aerobic exercise has been used as a relaxation technique (Morgan, et al., 1980 in LaPerriere et al., 1990). Improvements in autonomic reactivity and recovery may also allow the aerobically trained individual to cope more effectively with psychosocial stressors.

There is now substantial evidence suggesting that both a single episode of aerobic exercise and maintained improvements in aerobic fitness levels are associated with anxiety reduction and increased perceptions of psychological well-being (Bahrke & Morgan, 1978, Goldwater & Collis, 1985 & Morgan et al., 1980 in La Perriere et al., 1990).

Research studies focused on trait versus state anxiety, have supported the hypothesis that state-anxiety, which is related to specific life events, is more responsive to exercise than trait anxiety, which is persisting anxiety that appears to be related to personality.

Research also suggests, that physical exercise provides a beneficial adjunct for treatment of disorders like alcoholism and substance-abuse, which help improve and encourage self-image, social skills, and cognitive functioning (Lewis et al., 1993).

These observations have particular relevance for anxiety reduction in early symptomatic HIV infected individuals, as observed by a pilot study undertaken at the clinic and centre for behavioral medicine, where Wolff et al., (1996) found a positive correlation between decreases in levels of anxiety and vigor-activity levels due to 10 weeks of aerobic activity in a sample of early symptomatic HIV sero-positive patients.

1.21.1.3.5.2. THE RELATIONSHIP BETWEEN EXERCISE AND DEPRESSION.

Aerobic exercise training of various duration's has been shown to decrease depression. A six to twenty week aerobic exercise training program was found to be associated with a reduction in depression and an elevation in self-esteem (Morgan, 1981,1982, 1984a, 1984b in La Perriere et al., 1990). La Perriere et al., (1990) further observed that depression and anxiety are associated with immune suppression and have provided evidence that aerobic exercise training can attenuate these affective factors and enhance immune function.

Following ten weeks of aerobic exercise training, moderately depressed patients showed a significant decrease in depression as measured by the Beck Depression Inventory and the Profile of Mood States. Exercise has also been found to attenuate distress following HIV-1 sero-status notification (Antoni et al., 1991).

1.21.1.3.5.2.1. EXERCISE AND DEPRESSION- PHYSIOLOGICAL EXPLANATIONS.

From a physiological view point, aerobic exercise results in an increase in blood flow and oxygenation to our central nervous system. Exercise therapy is unique in that a sufficient frequency, intensity, and duration produces a wide range of physiological changes, including enhanced cardiorespiratory fitness, oxidation of fat, efficiency of peripheral blood distribution and return, fibrinolytic capability, growth hormone, tolerance to stress, prudent living habits and joy of living.

Aerobic exercise, also decreases serum cholesterol and trigylcerides, glucose intolerance, obesity, adiposity, platelet stickiness, arterial blood pressure, heart rate, vulnerability to dysrhythmias, overreaction to hormones, stress and depression (Johnsgard, 1989 & Sharkey, 1990).

A prominent physiological theory states that "if building a big, efficient heart results in a decreased physiological response to physical stress, it may also result in a decreased response to psychological stress, which in turn may reduce depressive reactions to such stress (Johnsgard, 1989).

1.21.1.3.5.2.2. EXERCISE AND DEPRESSION- BIOCHEMICAL EXPLANATIONS.

Perhaps the most intriguing hypotheses concerning exercise related to depression revolves around the so called "runner's high" and the euphoria producing brain chemical called beta endorphin. The chemical structure of the beta endorphin which we produce endogenously is very similar to that of opium and is 20 to 50 times more potent. There are some very seductive research findings which suggest that beta endorphin may well be involved in the exercise mood formula.

An analysis of brain tissue in rats, for example, reveals significant increases in opiate-receptor-site occupancy after they have been forced to run in an activity wheel or swim in cold water. It has also been demonstrated that mice that work out regularly can become swimming junkies. They show the same sort of dependency as that produced by morphine, exhibiting typical withdrawal symptoms when injected with the antagonist drug naloxone, a drug which interferes with beta endorphin locking into opiate receptor sites (Johnsgard, 1989).

Research on the effect of exercise on beta endorphin levels in human beings has been restricted to measuring levels of beta endorphin and its metabolites in our peripheral blood, the blood beyond the blood-brain barrier. Research done by Carr, in Johnsgard (1989) on unconditioned women undergoing rigorous and increasingly intense physical exercise program for two months indicated, that there is an "acute" or immediate response to exercise (beta endorphin levels elevate after only a couple of minutes of exercise) and also a "chronic effect", which builds overtime. The above-average endorphin levels produced by exercise in these women progressively rose as the weeks of increasingly vigorous exercise continued.

Appenzeller and Bortz, in Johnsgard (1989) found that plasma endorphin levels were elevated in ultra marathon runners competing in the arduous Western States 100 mountain race. The levels of plasma endorphins seem to peak at around 100% above normal in experienced marathon runners, this level is lower for less fit individuals.

1.21.1.3.5.3. EXERCISE AND SENSE OF PERSONAL CONTROL.

Aerobic exercise has been shown to enhance self-efficacy and active coping. Participation in exercise training has also been found to assist subjects to gain greater control over their physical conditions. These actual and subjectively perceived occurrences led to a greater sense of control in HIV-seropositive subjects in a study conducted by (LaPerriere et al., 1990). These positive aerobic exercise affects on measures of personal control were also found to have transpired to the South African setting, in a pilot study conducted by Wolff et al., (1996).

1.21.1.3.5.4. EXERCISE AND THE IMMUNE SYSTEM.

In recent years the number of investigators studying the relationship between exercise and the immune system has escalated dramatically world-wide. As one indication, the First International Symposium on Sport and the Immune System was held in Padderborn, Germany in November 1989. In this symposium, Fitzgerald (1991) reported that a similar pattern of immunomodulation occurs during both moderate and intense exercise, whereas only during severe exercise is there monocytosis and suppressed natural killer and bone marrow derived (B) lymphocyte function.

Previous studies have demonstrated that the immune system was affected even by single episodes of acute aerobic exercise (Hanson & Flaherty, 1981 & Hedfors, 1983). These studies indicate that acute aerobic exercise conducted at a moderate intensity increases trafficking of both T (thymus derived) and B lymphocytes.

In addition some functional indices of lymphocytes, including cytotoxic activity, have been augmented following acute exercise. One study for example, showed similar increases in NK cytotoxicity following only five-minutes of moderate aerobic exercise bike riding (Simon, 1984). These findings indicate that even very mild exercise may be able to induce immunomodulatory effects.

Watson, Moriguchi & Jackson (1986) showed an increase in the percentage of T lymphocytes after several weeks of endurance training in previously inactive but healthy young men.

Results of the 5-year study conducted by Schneiderman (1992) with asymptomatic HIV-seropositive individuals, showed increases in subsets of T lymphocytes following a moderate aerobic exercise training program.

A pilot study conducted by Wolff et al., (1996) with a sample of asymptomatic and early symptomatic HIV-seropositive patients, after 10-weeks of aerobic exercise combined with group-based cognitive-behavioral therapy, showed increases in total lymphocyte and CD4 T-cell counts. Although these increases were not statistically significant, they were clinically significant.

In summary, it is clear from the results obtained by the above studies that using exercise as a form of therapy in enhancing immune status has great potential and if used correctly as a therapeutic modality, can produce significant results in stimulating immune enhancement. Exercise as a form of therapy for HIV sero-positives also has significant implications. HIV-seropositive patients will now have the opportunity to participate actively in delaying the onset of the final clinical AIDS stage, and will not rely entirely on pharmacological therapy. In South-Africa, limited resources on the presently available antiviral medications for HIV sufferers, especially in the rural areas, as well as limited funds to obtain these medications, will make exercise a suitable and cost effective adjunctive mode of therapy available to all South-African AIDS sufferers.

1.22. ETHICAL CONSIDERATIONS IN TREATING HIV SERO-POSITIVE PATIENTS.

The difficulties associated with treating AIDS patients, were clearly noted in 1986, when the American Medical Association (AMA) acknowledged the special difficulties of providing AIDS care, when it stated that in spite of medicine's enduring tradition of treating patients with contagious diseases, "not everyone is emotionally able to care for patients with AIDS", despite its 1988 clarification stating that "a physician may not ethically refuse to treat a patient whose condition is within the physician's current realm of competence solely because the patient is seropositive (Silverman, 1993).
The AMA's original position reflected the ambiguity of professional responsibility that remains a point of debate to the present.

Loewy in Silverman (1993) noted that the very foundation of the social contract between the health care provider and the AIDS patient is currently being challenged as many health professionals question their obligation to treat AIDS patients, thus adding to the stress of the work a sense of uncertainty about the appropriate role, extent of professional responsibility, and duty of the caregiver. The social stigma associated with AIDS further challenges the tolerance and willingness of health care providers to treat these patients. Caregivers' feelings of primary allegiance to and positive regard for their patients and perhaps most important, providers confidence in their ability to mobilize effective skills to deal with disease are all severely tested by AIDS related work.

Taylor et al., in Silverman (1993) and Cohen et al., (1990) saw health care providers as burdened with the additional strain of being caught in the middle of societal debate about such controversial questions as euthanasia, caregiver-assisted suicide, mandatory HIV testing for and the duty to report seropositivity in patients and providers, and most recently the disclosure of seropositive caregivers and limitation of their professional activities.

1.23. SUMMARY OF THE LITERATURE REVIEW.

The Acquired Immunodeficiency syndrome (AIDS), has escalated dramatically over the past decade, and will continue to present a significant health challenge well into the 21st century. It is especially in sub-saharan Africa, where the proliferation of AIDS warrants urgent attention, as having changed from a primarily homosexually transmitted disease to a heterosexually transmitted disease. It is projected that Africa houses 8 million of the projected 13 million Human ImmunodeficiencyVirus (HIV)-seropositives in the world, and it is envisaged that by the year 2000, 14 million people will be seropositive for the HIV.

While medical research in the first decade has increased understanding of many aspects of HIV infection, and developed pharmacological agents to treat the opportunistic infections associated with HIV infection during the later stages of the AIDS disease, behavioral change still remains the only means of primary prevention against infectivity with the virus. With the development of more effective medications for the later clinical stages of HIV infection, there is also now a fast-growing population of asymptomatic and early symptomatic (pre-AIDS) individuals who are having to cope with the complex and multiple psychosocial demands of a chronic life threatening disease.

Despite the positive contributions of biomedical treatments for reducing opportunistic infections associated with the later clinical stages of HIV infection, it is well known that the presently available pharmacological treatments can at best prolong the life expectancy and functionality of HIV-seropositives by inhibiting the progression of the HIV. Although these pharmacological treatments have the ability to improve the immune status of HIV infected persons, and reduce opportunistic infections, they do so with numerous undesirable physiological side effects, such as suppression of the bone-marrow, anemia and a drop in the white blood cell count, which in turn may increase the likelihood of opportunistic infections. The available retroviral agents are further limited in their effect, to prolongation of the onset of clinical symptomatology and final mortality and do not constitute a cure for HIV infection or AIDS.

It is further noteworthy, that the presently available medications are of very little value in the asymptomatic and early symptomatic stages of HIV infection. During the asymptomatic and early symptomatic stages of HIV infection which can last up to 10 years, HIV infected individuals are still capable of transmitting the virus. Even though the infected individuals seem relatively healthy during these early stages of infection, several immune parameters are already suppressed. It is also during these early stages of HIV-infection, that greater anxiety and physiological tension is experienced, with the asymptomatic stage showing the highest levels of psychological distress, due to the uncertainty of the implications associated with the HIV seropositive status.
Of further note, is that HIV-seropositive patients normally start using antiviral medications early in their infection, and by doing so increase the serious hematological side-effects associated with these drugs, especially after long term use. By decreasing the use of these antiviral medications during the asymptomatic and early symptomatic stages of HIV infection, and by utilising behavioral interventions as adjunctive treatments to the presently available biomedical treatments, the risk of developing side-effects decreases and immune enhancement could take place without the serious and undesirable physiological side effects associated with long term antiviral drug use. It is therefore, especially in the asymptomatic and early symptomatic stages of HIV-infection, where antiviral agents are of little value, and when anxiety and physiological tension levels are unmanageable, that adjunctive treatment methods to the presently available biomedical treatments have become necessary.

One of the most widely used behavioral therapeutic approaches with HIV-seropositive persons in the last decade, has been cognitive-behavioral therapy. Cognitive-behavioral therapy is much commended and admired because of its extremely beneficial and powerful function to facilitate change in HIV-seropositive patients. The strength that this form of therapy has, is in part, due to the clear, overt statements of goals which are desired to be achieved, giving the patient and therapist definite aims and thus minimizing false hopes.

The mechanisms that are used for achieving these goals are quite concrete and allow patients to witness any progress that they make, making the therapeutic experience a fruitful life experience with practical benefits. The cornerstone of Cognitive-behavioral models is the assumption that individuals interpretation of events can have an important influence on their emotional state and behavior. Though there are divergence's amongst cognitive-behavioral models, there is a consensus that thought processes, emotions, and behavior are interdependent. In cognitive-behavioral therapy, each person is seen as unique with very specific needs, hopes and meanings that form the basis of their therapeutic process. Cognitive-behavioral methods are also most often used to empower persons who do not possess natural coping mechanisms, and are thus not able to deal with stressful situations, which exceed their capabilities. This type of therapy is seen to hold the greatest potential for lowering levels of stress or discomfort, as it provides patients with information and deals more directly with psychosocial issues related to HIV infection and the AIDS disease, as well as management of psychological and sociocultural factors.

Cognitive behavioural interventions have also been found to produce improvements in psychological and physiological functioning. These interventions have further been shown to buffer post-notification depression levels, decrease levels of anxiety and emotional distress and increase NK cell activity and CD-4 / T-lymphocyte cell counts in HIV-seropositive persons (Antoni et al., 1990). They have further been found to retard disease progression in asymptomatic HIV-seropositives (Antoni et al., 1990). Weisse (1992) alleges that cognitive-behavioral therapy has been shown to be as effective as pharmacotherapy, an advantage being that it does not interfere with immunologic processes.

Studies utilizing aerobic exercise as a behavioral treatment method have also demonstrated positive effects on immunologic and physiological indices and psychological status of HIV-seropositive persons.

Aerobic exercise programs have been found to enhance both cellular and humoral immune functioning, along with reducing emotional distress, producing immunomodulatory effects and have been associated with enhanced immune functioning as well as retarding of HIV disease progression in HIV-seropositive patients (Antoni et al., 1990). LaPerriere et al., (1990) and Schneiderman (1992) further reported that physical activity is related to survival time for those infected with the AIDS virus, and that an increase in aerobic fitness is accompanied by potentially beneficial increases in T-lymphocyte subsets among HIV seropositive individuals.

Although Cognitive-behavioral therapeutic approaches and Aerobic exercise have in isolation produced positive contributions for treating HIV-seropositive persons, it is especially when combining the two treatment methods that demonstrably useful results with HIV-seropositive patients have been produced (Antoni et al., 1990 & Wolff et al., 1996). Research done at the Center for the Biopsychosocial Study of AIDS, at the University of Miami medical school, indicated that a combined aerobic exercise and cognitive-behavioral intervention lead to improvements in the immune status of HIV-seropositive individuals, but also showed that individuals had decreased anxiety and depression levels due to improvements in mood states (Antoni et al., 1990).

In a pilot study undertaken by Wolff et al., (1996) a group of asymptomatic Human immunodeficiency Virus (HIV), and early symptomatic Acquired Immunodeficieny Syndrome (AIDS) patients, were subjected to a group-based cognitive-behavioral intervention as well as an aerobic exercise intervention and evaluated in terms of its impact on their psychosocial status as well as immunologic status (lymphocyte subsets). It was found that the combined exercise and cognitive-behavioral group intervention produced significant improvements on levels of anger expression, depression, self-efficacy and impact of the illness. There were also some improvements in the immunologic status of the patients, and although the lymphocyte subset counts were not found to be statistically significant, they were found to be clinically significant.

Despite the positive contributions of the pilot study in reducing levels of anger expression, depression, and increasing coping self efficacy amongst asymptomatic HIV-seropositives, the pilot study lacked the efficacy to reduce the physiological component of anxiety experienced particularly by asymptomatic and early symptomatic HIV-seropositive patients. The pilot study also failed to produce statistically significant positive changes in the immunological status of HIV-seropositives, and was limited to producing clinically significant changes which could not be generalised to larger populations of HIV-seropositives. Another limitation of the pilot study was that it was uncertain whether the acquired changes experienced by the asymptomatic HIV-seropositive patients would remain durable over a period of time. In order to overcome the limitations of the pilot study in reducing the physiological component of anxiety, and in order to provide a direct operant intervention in enhancing immune system functioning in asymptomatic and early symptomatic HIV-seropositives, it was envisaged to use electromyographic (EMG) biofeedback-assisted relaxation training. The present health psychology\ behavioral medicine literature would seem to indicate that EMG-biofeedback assisted relaxation training as a treatment method for the physiological component of anxiety has become rapidly accepted as a therapeutic alternative to medication (Weinman, Semchuk & Gaebe, 1983 & Schwartz & associates, 1987). Various studies have also shown that EMG biofeedback-assisted relaxation training can effectively reduce tension in the frontalis muscle of the forehead, and concluded that this muscle relaxation should generalize to other muscle groups (Schwartz & Beatty, 1977 & Schwartz & associates, 1987). EMG-biofeedback, is considered one of the more useful forms of feedback for training low arousal patterns, as it involves some voluntary as well as involuntary control, and thus learning accrues at a faster rate than with the training of completely involuntary responses. Moreover, the skeletal muscle system comprises a large percentage of the entire bodily mass and therefore a change in this system can, and usually does, produce changes in other systems, such as the central nervous system (CNS) and the autonomic nervous system (ANS).

The present literature would also seem to support the argument that EMG-biofeedback assisted relaxation training, is superior to either group therapy or progressive muscle relaxation in reducing physiological tension. In a study completed by Townsend, House, and Addario (1975) it was reported that EMG-biofeedback assisted relaxation training was found be superior to group therapy, and Canter, Kondo, and Knott (1975) found EMG-training superior to progressive muscle relaxation in reducing physiological tension levels (Gatchel & Price, 1979). Auerbach, Oleson & Solomon (1992) reported that biofeedback served as an effective adjunctive treatment method for persons suffering from AIDS-related complex and AIDS. They further reported that biofeedback assisted relaxation training was found to be more effective then guided imagery and hypnosis in treating these patients. Further literature indicates that EMG-biofeedback assisted relaxation training can also have a direct effect on immune function. Although literature investigating the effects of biofeedback training on immune function amongst asymptomatic and early symptomatic HIV-seropositives is limited, studies that have been conducted with rheumatoid arthritis patients found that a combined EMG-biofeedback and cognitive-behavioral intervention produced cellular immune enhancements and a decreased rheumatoid factor (an autoimmune antibody) (Bradley, Turner, Young, Agudelo, Anderson & McDaniel, 1985). In a study with metastatic cancer patients completed by Gruber, Hall, Hersch & Dubois (1988) it was reported that after receiving 6-weeks of biofeedback assisted relaxation training, cancer patients improved their immune response by enhancing their lymphocyte and Natural killer cell activity.

A study conducted by Peavey, Lawlis, & Goven (1985) utilizing EMG biofeedback-assisted relaxation further reported significant decreases in tension and anxiety in high stress subjects and improvements in the quality of phagocytic neutrophils associated with immunity in these persons.

It would thus appear from the above literature that EMG biofeedback-relaxation training produces therapeutic improvements above and beyond that which is effected by traditional therapy and progressive muscle relaxation, and that these effects could also be acheived by HIV-seropositives, especially asymptomatic and early symptomatic patients.

With the present literature in mind, and with further consideration of the seriousness of the AIDS pandemic in South-Africa, as well as the absence of suitable pharmacological agents, especially for the earlier stages of HIV infection, a combined 8-week psychophysiological intervention within a biopsychosocial framework, utilizing individualised cognitive-behavioral therapy, aerobic exercise and Electromyographic-(EMG) biofeedback assisted relaxation training was developed. The aim of this intervention was to serve as a more suitable and cost effective adjunctive treatment method to the presently available pharmacological treatments. More specifically, the theoretical assumptions underlying this study were as follows: Biopsychosocial interventions, with an emphasis on cognitive-behavioral therapy and aerobic activity, can and normally do produce significant differences in the psychoimmunological status of HIV-seropositives. This theoretical assumption as the above cited literature indicates, has been tested by studies in the United States (Antoni et al., 1990, LaPerriere et al., 1990 & Schneiderman, 1992) as well as in South-Africa, Wolff et al., (1996) and found to be applicable to particularly asymptomatic and early symptomatic HIV-seropositives. The second theoretical assumption, which has not been tested in the HIV\AIDS population, and particularly in asymptomatic and early symptomatic HIV-seropositives in South-Africa, is that EMG-biofeedback, a direct operant intervention in a psychophysiological modality will have an indirect effect in enhancing immune system functioning, either by means of a psychophysiological mechanism, or by means of the relaxation effect which it produces.

It was further assumed that by combining the therapeutic modalities mentioned above it would be possible to produce significant positive changes in those psychological states more specifically related to psychophysiological and or physical functioning. These would include, vigor-activity and fatigue-inertia levels.

Fatigue is associated with HIV from the early-stage acute infections through late-stage AIDS. It increases in severity with disease progression and impairs the individuals ability to perform even normal daily activities (Eller, 1995). It has also been positively correlated with immunosuppression and therefore disease progression in HIV-seropositives (LaPerriere et al., 1990 & Eller, 1995). Significant positive changes in the fatigue levels of HIV-seropositives, were expected to correlate with increases in the vigor-activity levels of these persons, therefore, bringing about a more active approach to the treatment of HIV-infection. It was further expected, that a decrease in the overall fatigue levels of HIV-seropositives should correlate positively with the immunosuppression experienced by these persons and therefore cause a delay in the onset of symptoms associated with the later clinical AIDS stages.

CHAPTER 2

METHODOLOGY

2.1 INTRODUCTION.

The objective of this study was to evaluate the effects of a combined biopsychosocial treatment intervention utilizing individualized cognitive-behavioral therapy, ergometric aerobic exercise and Electromyographic feedback, on South-African subjects who were seropositive for the Human Immunodeficiency Virus (HIV), and were either asymptomatic or early symptomatic Acquired Immunodeficiency Syndrome (AIDS) sufferers, (According to the Center for Disease Control, CDC stages 2 and 3 and the Walter Reed, WR system stages 2-4 A with CD4-T lymphocyte counts of above 200).

The combined biopsychosocial treatment intervention of electromyographic (EMG) biofeedback assisted relaxation training, cognitive-behavioral therapy and ergometric aerobic exercise was presented on an individual basis over a period of 8 weeks, as change agent to facilitate causal analysis.

2.1.1 BACKGROUND ON HIV INFECTION AND AIDS.

Human Immunodeficiency virus (HIV) infection results in a prolonged illness of approximately 10 to 15 years which culminates in Acquired Immune deficiency syndrome (AIDS), and eventually death. Initial exposure to the HIV results in relatively mild disease. Infected individuals then enter an asymptomatic phase of relative stability where there are either no clinical symptoms (CDC stage 2) or only mild symptoms such as persistent generalized lymphadenopathy (CDC stage 3). This asymptomatic period may last for several years, and is followed by declining immune functioning as evidenced by decreasing CD4 T- lymphocyte counts (Antoni et al., 1990 & Schneiderman, 1992). As immune function further declines, HIV replication increases and individuals become symptomatic with HIV-related illness.

Individuals may then enter AIDS related complex (ARC), a phase of constitutional symptoms (CDC stage 4 A) consisting of involuntary weight loss, diarrhea, fever and/or secondary infections such as oral candidiasis (thrush) and oral hairy leukoplakia (CDC stage 4 C-2). The emergence of severe opportunistic infections (CDC stage 4 C-1, such as pneumocystis carinii pneumonia, toxoplasmosis, progressive multifocal leukoencephalopathy), secondary cancers (CDC stage 4 D, such as lymphoma, Kaposi's sarcoma), neurological disease (CDC stage 4 B and AIDS dementia), and illness due to direct effects of the virus itself marks the onset of AIDS (Antoni et al., 1990 & Antoni et al., 1991).

2.1.2 RESEARCH PROBLEM.

The AIDS pandemic, questionably at its most virulent in Africa and soon converging on South-Africa by virtue of the country's health infrastructure will probably place the greatest strain ever on South-African financial and health resources.

It has also become well-known that the need for treatment and management of HIV-seropositive patients will outstrip the presently available health resources to such an extent, that it could destroy the social infrastructure of South-Africa (Epidemiological comments, 1995). Herein, it would appear that the present available medical treatment would not be sufficient to stem this tide. No effective pharmacological treatment has been found, as the retroviral agents only cause a temporary inhibition of the progression of the HIV and not a permanent cessation of the activity of the virus.

Adding to the above problem the high cost of the available antiviral medications, as well as the hematological side-effects associated with long term use of these drugs, (especially if used during the asymptomatic and early symptomatic stages of HIV infection), makes them less efficient for use, therefore requiring adjunctive treatment methods.

2.1.3 RATIONALE-MOTIVATION FOR THE STUDY

In considering the large problem that presently exists with the AIDS pandemic in Africa, including South-Africa, it was reasoned that a dire necessity existed for the development of adjunctive treatment methods to the present pharmacological treatments.
Such a treatment method utilizing group-based cognitive-behavioral therapy and aerobic exercise of a 10-week duration was found to produce significant psychological changes, which in turn lead to clinically significant immunological improvements in a sample of asymptomatic HIV- seropositive patients. This intervention served as a pilot study to the present research (Wolff et al., 1996).

Similar research performed by Antoni et al., (1990) utilizing cognitive-behavioral therapy, showed that the suppressed immunological functioning found in asymptomatic and early symptomatic HIV-seropositive patients suggests that biopsychosocial interventions specifically designed to enhance immune competence at early stages of HIV-infection may provide a means for increasing resistance to opportunistic infections.

In South Africa, this research could take on an expanded significance. Persons infected with the HIV living in the rural areas will be provided with the opportunity to overcome accessibility and financial barriers associated with obtaining antiviral pharmacological agents, by replacing these substances, especially in the early stages (CDC stages 2 and 3 of HIV infection), where antiviral medications are of little value, with the biopsychosocial intervention utilized in this study.

2.1.4 RESEARCH HYPOTHESES.

The specific Research Hypotheses for this study were:

(1) There would be greater increases in the total lymphocyte and CD4 T-cell mediated immune counts, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and Electromyographic (EMG)-feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

(2) There would be greater clinical improvements in the CD4:CD8 T-lymphocyte cell ratio, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

3a) There would be greater decreases in depression levels, as measured by the Beck Depression Inventory (B D I) and the Profile of Mood States (POMS) factor D, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

3b) There would be greater decreases in tension-anxiety levels, as measured by the POMS factor T, and decreases in EMG -physiological tension levels, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

3c) There would be greater decreases in fatigue-inertia levels, as measured by the POMS factor F, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

(4) There would be greater increases in Vigor-activity levels, as measured by the POMS factor V, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

2.2 SUBJECTS

This study was based on a group of South-African HIV-seropositive individuals, who were either asymptomatic or early symptomatic AIDS sufferers, (CDC stages 2 and 3 and\ or Walter Reed stages 2-4 A, with CD4-T lymphocyte counts of above 200).
For the purpose of this study the term "subjects", whether male or female, was used to refer to all patients or participants taking part in the intervention. The term "patient" in psychological terms normally implies that a person is suffering from a mental disorder or abnormality. For the purpose of this study, HIV-seropositive individuals had been diagnosed with an infectious medical condition and the term "patient" (subject), did not imply that the person was suffering from any psychopathology (as set out by DSM-IV criteria), unless otherwise specified.

2.2.1 SAMPLE GROUP

Twenty-six (26) subjects, from a larger population of (N= 98) HIV sero-positive patients that fitted the inclusion criteria of this study were selected and randomly divided into an experimental (n=14) and a waiting list control group, (n=12).

All subjects were either asymptomatic or early symptomatic HIV-seropositives with baseline recordings of CD4-T lymphocyte counts of above 200, (CDC stages 2-3 and WR stages 2-4, please see inclusion criteria under Section 2.2.3) Only 2 subjects in the experimental group were recorded as having CD4-T lymphocyte baseline counts of below 200, but were allowed to participate in the intervention for ethical reasons, (i.e they were spouses of other participants). All subjects in the control group were recorded as having CD4-T lymphocyte baseline counts of above 200. The subjects ranged in age between 24-42, were either male or female, and South Africans. Their socio-economic background was more or less similar. The subjects may have become infected through any means, (i.e homosexual transmission, heterosexual transmission, transfusion, open wound infection or intravenous drug transmission). More specifically, the experimental or treatment group was composed of 14 subjects, of which 6 were male and 8 female. The delayed treatment control group consisted of 12 subjects, of which 5 were male and 7 female. The average age of the males in the experimental group was 32,6 and the average female age was 31,2. The average age of the males in the control group was 31,0 and the average age of the females was 30,5. The exposure categories in the experimental group were 1 homosexual male and 5 heterosexual males and 8 heterosexual females. The control group was composed of 2 heterosexual and 3 homosexual males as well as 7 heterosexual females. The ethnic composition of subjects in both the experimental and the control group was all black South-Africans, staying permanently in South-Africa.

2.2.2 RECRUITMENT OF SUBJECTS

Permission was obtained by the Superintendent of Hillbrow Hospital in Johannesburg, Gauteng to recruit patients that attended their outpatient HIV\ AIDS Clinic.
More specifically, and in collaboration with Professor Ruben Sher, the nursing staff and social workers of Hillbrow Hospital in Johannesburg, South Africa, patients were screened according to specific exclusion and inclusion criteria and then initiated to the program been offered at the Clinic and Centre for Behavioral Medicine. All Subjects were recruited at the same time.

Due to the large attendance of HIV patients at Hillbrow Hospital approximately 20 new patients per week, no problems were anticipated in recruiting the necessary sample for this study. Furthermore, with the permission of Professor Ruben Sher and the assistance of the South-African Institute for Medical Research, all immune results of patients taking part in the program were made available to me. All patients that lived within the Gauteng region were provided with transport to and from the Clinic and Centre for Behavioral Medicine. Patients that lived outside the Gauteng region and were financially unable to provide for their own transport, were provided with funds to cover their transport needs.

2.2.3 INCLUSION CRITERIA

Eligible subjects for this study had to adhere to the following inclusion criteria:

1. HIV- seropositive as stipulated by the World Health Organization (WHO), criteria.
2. HIV-seropositive status according to Center for disease Control, (CDC) stages 2 and 3 and the Walter Reed classification system, (WR) stages 2-4 A with CD4-T lymphocyte baseline counts of above 200.
3. 18 - 45 years of age.
4. Physically able to participate in the Aerobic Exercise
5. Mentally able to participate and benefit from the therapeutic sessions.
6. At least a standard 7 Education.
7. South African living in South-Africa.

2.2.4 EXCLUSION CRITERIA

Exclusion criteria for this study included:

1. Age less than 18 or greater than 45.
2. Any WHO criteria for AIDS, (Beyond stage 3 of CDC classification criteria or beyond stage 4 A of WR classification criteria i.e CD4-T lymphocyte baseline counts of below 200).

3 Any history of drug or alcohol abuse within 6 months as determined by (DSM IV criteria).

4. Any current major psychiatric disorder (for e.g organic mental disorder, schizophrenia, other than adjustment disorder).

5. Regular use of medications within the last 6 months that might have any immunological effects.

6. Participation in any formal interventions for the prior six months to remove the extraneous effects of any concurrent treatments on outcome measures.

2.2.5 SUBJECT CONSENT FORMS

Subject consent forms were drawn up in order to obtain consent from all subjects that would participate in the study. The consent forms further served to inform all participating subjects of the purpose of the study, as well as the procedures involved, the risks, benefits, the confidentiality of research data and the right to withdraw from the study at any time. Subjects had to read and understand the contents of these forms, and after acknowledging that they understood the contents and were fully aware of the study procedure, they could decide whether or not to take part in the study. The informed consent was then to be reviewed in detail and subjects had to agree to abide and sign the form after agreeing to the terms specified, (see Appendix A).

2.3 ASSESSMENTS

2.3.1 MEDICAL ASSESSMENT.

An assessment of Blood pressure as a ratio of Systolic-Diastolic, Heart rate and body temperature was attained at a pre-intervention phase, in order to determine whether subjects were able to participate in the aerobic exercise sessions and to assess aerobic exercise training effects following the intervention. After receiving an Electrocardiograph, medical clearance was obtained by a medical practitioner in order for experimental subjects to participate in the aerobic exercise component of the intervention.

2.3.2 IMMUNOLOGIC ASSESSMENT.

It has been suggested that multiple indicators of cellular immunity should be used as outcome measures in clinical studies of HIV infection Eller, (1995). Therefore, four surrogate markers of cellular immunity were selected for examination: Total lymphocyte counts, CD4-T lymphocyte and CD8-T lymphocyte subset counts, as well as CD4: CD8-T lymphocyte subset ratio counts. These measures were phenotypic and functional markers previously shown to be effected by behavioral interventions as well as have potential clinical relevance for HIV infected persons. They have further been validated in other studies as appropriate indicators of the effects on immunity of cognitive-behavioral interventions in persons infected with HIV (Antoni et al., 1990 & 1991 and Woff et al., 1996). The CD4-T lymphocyte count serves as an indicator of disease progression and correlates highly with symptom severity. It is the most frequently used marker for disease progression and response to clinical interventions. The CD8-T lymphocyte is an important marker of immunity in persons seropositive for HIV, in its relative proportion to the CD4-T lymphocyte. The CD4:CD8 ratio is related to severity of symptoms experienced by HIV patients, including, fatigue, decreased vigor and depression. The CD4:CD8-T lymphocyte ratio, also known as the helper : suppresor ratio becomes reversed as the number of CD8 cells increase. The aim of clinical interventions is therefore, to increase the CD4-T lymphocyte count and decrease the CD8-T lymphocyte count, as well as retain a proportional CD4:CD8 ratio.

The blood assay analysis of the T-lymphocyte subsets was performed by the South-African institute for medical research. All blood samples were analysed under the strict control of medical microbiologists working for the South-African institute for medical research, under the supervision of Prof. R. Sher, Head of the outpatient AIDS clinic at Hillbrow Hospital in Johannesburg. More specifically, seven milliliteres of whole peripheral blood were collected aseptically by venipuncture into a blood collection tube containing the anticoagulant ethylenediamine tetra-acetic acid (EDTA). Blood samples were maintained at room temperature and analyzed within 24 hours.

Following preperation with the CoulterImmuno-Lyse whole blood lysis procedure. Total lymphocytes. CD4 + And CD8+ T lymphocyte subsets were analyzed by flow cytometry with dual color direct immunofluorescence using the EPICS Profile II. The percentage of positively stained cells for each cell surface antigen was obtained from a count of 5.000 cells. Counter Clone T4 monoclonal antibodies conjugated to RD1. and T8 monoclonal antibodies conjugated to fluorescein isothiocynate (FITC) were used to label CD4 + and CD8 + T lymphocytes. respectively. The above procedures. were performed at baseline and post-test phases of the treatment intervention. for subjects in both the experimental and control groups. The finding of no significant differences between subjects of the two groups. supported the accuracy of the laboratory analyses.

2.3.3 EMG -BIOFEEDBACK ASSESSMENT.

Biofeedback-assisted relaxation training was conducted in a 4 by 6-metre room that was dimly lit during biofeedback assessments and training. Patients were seated in a fully reclined position. in a recliner chair. The lights in the room were dimmed. and there were no surrounding noises to disturb the subject. Pillows were also used to provide support and comfort to the patient. and to assist the patient in recognizing a state of general relaxation.

Silver chloride EMG electrodes were applied to the frontalis muscle of the forehead. after the patients forehead had been cleansed with alcohol. The conducting medium was Hewlet Packare Redux Paste. Placement of electrodes was facilitated by having the patient raise his\ her eyebrows so that the experimenter could visualise the frontalis muscle. thereby allowing for individual differences to be noticed. An active recording electrode was placed above each pupil in the center of the forehead. Electromyographic-feedback was provided using the biofeedback instrument (EMG 100T. manufactured by Thought Technology). measuring in microvolts (mv) /rms. Feedback of the frontalis muscle activity was provided in an auditory form through a speaker placed near the patients right ear and consisted of a tone that pulsated at a steady rate while the volume of the tone varied in proportion to the EMG level.

The EMG audio-feedback was initially turned to a very low volume, and a rise in the volume indicated an increase in frontalis muscle activity. EMG-feedback pre-assessments, included two 5-minute EMG baseline readings taken by instructing the subject to"Lie back, close your eyes and allow yourself to be as comfortable as you can. At the end of the 5-minute period, I will ask you to open your eyes, ending the five minute rest period." The same instructions were given for the second 5-minute baseline. The average of these two 5-minute baselines constituted the relaxation level. Included during the pre-assessment evaluations was information and instuctions regarding the process and treatment success expectations of biofeedback.

Further assessments were taken during the EMG-feedback training sessions.

More specifically, psychophysiological tension levels were assessed over the 5-week duration of the EMG-feedback training sessions, composed of 1 twenty minute session per week, with readings been taken at 5-minute intervals. The purpose of these treatment sessions was to train subjects to a specified criterion level. This level was EMG frontalis below 1.5 microvolts (integral average). Following the baseline and feedback training assessments, subjects were again assessed at a 6-week follow-up phase. During this 6-week follow-up phase, the ability of the subjects to relax without the assistance of the feedback equipment was assessed. More specifically, after a 2-minute stabilization period, EMG activity of the frontalis was recorded for 10-minutes, and an overall single mean value for each subject was obtained. This 10-minute session did not allow patients to utilise the assistance of the biofeedback equipment. This was done, in order to assess the subjects ability to relax and voluntarily control their own physiological tension levels. Please see (section 2.6) for further description of the biofeedback-training procedure. The above method utilized for this study was recommended by Schwartz & associates (1987).

2.3.4 PSYCHOLOGICAL ASSESSMENT.

The psychological measures used for this study included the Profile of Mood States (POMS), and the Beck Depression Inventory (BDI). These measures were administered on an individual basis at baseline and post-test intervals. Subjects were asked to be as honest as possible when completing the devices and were informed that there were no correct or incorrect answers. They were further informed that these measures would assist the therapists in better understanding their mood and emotional states, and therefore, formulate a more accurate therapeutic intervention.

2.3.4.1 PROFILE OF MOOD STATES (POMS)

The profile of Mood States (POMS), was originally developed by the Nowlis and Green (1957) and Sells, Barry, Trites and Chinn (1956) reports (McNair, Lorr and Droppleman, 1992). In its present form of 65 five-point adjective rating scales, the POMS represents the refinement of a total of 100 different adjective scales by means of repeated factor analysis. It is a practically, self-administering psychometric test, and can be administered either to individuals or to groups. It is a rapid and economical method of identifying and assessing transient, fluctuating affective states. The POMS is recommended primarily as a measure of mood states in psychiatric outpatients and as a method for assessing changes in such patients. It is also recommended for similar purposes, but only on a research basis for normal subjects of age 18 and older who have had at least two years of high school education.

Most subjects complete the POMS in about 3-5 minutes, and it can be administered easily by research assistants, technicians, or clerical personnel. Typically, persons with at least a standard 7 education have little or no difficulty in understanding the POMS.

It consists of six sub-scales measuring several identifiable mood or affective states. The six sub-scales are Tension-Anxiety, Depression-Dejection, Anger-Hostility, Vigor-Activity, Fatigue-Inertia and Confusion-Bewilderment.

These mood scales have proved to be particularly useful descriptive measures for assessing psychiatric outpatients and very sensitive indicators of their responses to various therapeutic approaches. The POMS has also proved to be a sensitive measure of the effects of various experimental manipulations upon normal subjects and other non psychiatric populations.

The Tension-Anxiety or factor T sub-scale is defined by adjective scales descriptive of heightened musculoskeletal tension. The defining scales include reports of somatic tension which may not be overtly observable (Tense, On edge), as well as observable psychomotor manifestations (Shaky, Restless). Correlations of the scales with the factor are generally consistent across the six replications. Adjectives which refer to vague, diffuse anxiety states (Anxious, Uneasy) tend to have slightly lower loadings. A number of scales were dropped from the Tension factor after use in one or more studies because of low factor correlations or multivocality. These scales tended to be adjuctives which refer to generalized states of discomfort (Worried, Impatient, Upset, Irritable).

The Depression-Dejection or factor D sub-scale appears to represent a mood of depression accompanied by a sense of personal inadequacy. It is best defined by scales indicating feelings of personal worthlessness (Unworthy), futility regarding the struggle to adjust (Hopeless, Desperate), a sense of emotional isolation from others (Blue, Lonely, Helpless, Miserable), sadness (Sad, Unhappy) and guilt (Guilt, Sorry for things done).

The Anger-Hostility or factor A sub-scale appears to represent a mood of anger and antipathy towards others. The principal defining scales (Angry, Furious, Ready to fight) have been repeatedly replicated and their factor correlations are consistent across studies. They describe feelings of intense, overt anger. "Grouchy" and "Annoyed" describe milder feelings of hostility, and their factor correlations are also relatively consistent across studies.

"Resentful," "Spitful," "Deceived," and "Bitter," items referring to more sullen and suspicious components of hostility, have been replicated in four or more studies. "Peeved," "Bad-tempered," and "Rebellious," were added to broaden Anger in various studies.

The Vigor-Activity or factor V sub-scale is defined by adjectives suggesting a mood of vigorousness, ebullience, and high energy. It is negatively related to the other POMS factors. To some extend Vigor probably represents a positive affect factor since, in several studies, all the items included in an attempt to define Friendliness have high loadings on the Vigor factor.

The Fatigue-Inertia or factor F sub-scale represents a mood of weariness, inertia and low energy level. It has been confirmed in six studies. "Tired" and "Fatigued" appeared to be a doublet in both Studies 1 and 3 and "Tired" was dropped in subsequent forms of the POMS. While negatively related, F and V appear to be independent factors and not opposite poles of a single bipolar factor. This appears to be the case of both the "PAST WEEK" and "RIGHT NOW" rating periods.

The Confusion-Bewilderment or factor C sub-scale appears to be characterized by bewilderment and muddleheadedness and has now been confirmed in 3 Studies. There is doubt as to whether the factor represents a trait of cognitive inefficiency, a mood state, or both. One possibility is that C is related to the classical organized-disorganized dimension of emotion. It may represent a self-report of cognitive efficiency, possible a by-product of anxiety or related states.

A Total Mood Disturbance Score may be obtained by summing the scores (with Vigor weighted negatively) on the six primary mood factors. The five scale scores of Tension, Depression, Anxiety, Fatigue and Confusion are added together and Vigor is subtracted from these scores.

This psychometric measure was chosen specifically for this study, because it was designed for and standardized on a non-psychiatric sample and has previously been used in studies of the impact of notification of HIV-antibody status (Antoni et al., 1991, Schneiderman, 1992 & Wolff et al., 1996).

The reliability of the POMS has also been found to be significantly high.
More specifically, the extent to which the individual items within the six mood sub-scales measure the same factor are near 0.90 or above. The test-retest reliability, is also very high, with correlation coefficients of between 0.80 and 0.90. Such high reliability's indicate the rank ordering of scores to be approximately the same on repeated occasions.

The six factor analytic replications in the development of the POMS may further be taken as evidence of the factorial validity of the six mood factors. An examination of the individual items defining each mood scale supports the face or content validity of the factor scores. In addition, seven areas of research have provided evidence of the predictive and construct validity of the POMS. These seven areas are: brief psychotherapy studies, controlled outpatient drug trials, cancer research, drug abuse and addiction research, studies of response to emotion-inducing conditions, research on sports and athletes and studies of concurrent validity coefficients and other POMS correlates (McNair, Lorr and Droppleman, 1992).

2.3.4.2 THE BECK DEPRESSION INVENTORY.

The Beck Depression Inventory (BDI), is a widely used easily available and easily administered self-report psychometric instrument for assessing depression in various populations and settings. The full scale consists of 21 items, making a maximum total score of 63.

Persons with a score of between 14-20 are considered to be mildly depressed, 21-26 moderately depressed and a total score of 26 and above, severely depressed. A total score of 20 or above, is considered a reliable criterion, in selecting or excluding subjects for research purposes (Scott, 1989). Reliability and validity have been directly assessed in recent research. Studies of internal consistency and stability of the instrument indicate a high degree of reliability. Use of several reliability-testing paradigms (test re-test, split half and coefficient alpha) showed acceptable reliability (0.90, 0.84, and 0.91 respectively), for both clinical and nonclinical groups (Gatewood-Colwell, Kazmarek & Ames, 1989).

Comparisons between the scores on the inventory and the clinical judgments of diagnosticians indicate a high degree of validity. The inventory was further able to discriminate effectively among groups of patients with varying degrees of depression. It was also able to reflect changes in the intensity of depression after an interval of time.

In view of these attributes of reliability and validity, this instrument is presented as a useful psychometric tool for research study of depression, and as a step in the direction of placing psychiatric and psychological diagnosis on a quantitative basis (Beck, Ward, Mendelson, Mock & Erbaugg, 1961).

The ability of the inventory to approximate clinical judgments of intensity of depression, offers a further number of advantages in its use for research purposes.
Firstly, it meets the problem of the variability of clinical judgment of nosological entities and provides a standardized, consistent measure that is not sensitive to the theoretical orientation or idiosyncrasies of the individual who administers it.
Secondly, since the inventory can be administered by an interviewer who is easily trained in its use, it is far more economical than a clinical psychiatric interview.

Thirdly, since the inventory provides a numerical score, it facilitates comparison with other quantitative data. Finally, since the inventory reflects changes in the depth of depression over time, it provides an objective measure for judging improvement resulting from psychotherapy, drug therapy or any other forms of treatment (Beck, Ward, Mendelson, Mock & Erbaugg, 1961).

2.4 PROCEDURE

The twenty-six (26), HIV asymptomatic and early symptomatic subjects that fitted the inclusion criteria for this study were randomized into an experimental (n=14) and waiting list control group, (n=12). The experimental or treatment group, received an 8-week combined intervention utilizing cognitive-behavioral therapy, aerobic exercise and electromyographic (EMG) biofeedback-assisted relaxation. The intervention was administered individually, with the assistance of 1 doctoral student in psychology, as well as an exercise physiologist. Both therapists had approximately equivalent training in cognitive-behavioral and biofeedback approaches. Throughout the treatment program both therapists received 2 hours per week of supervision from Prof. E. Wolff, who is a licensed psychologist in procedures specific to the experimental treatments of this study.

Experimental subjects met on a bi-weekly basis for 1 hour and 30 minutes. They received 45 minutes of cognitive-behavioral therapy and 45 minutes of aerobic exercise in the one session, and 20 minutes of electromyographic (EMG) biofeedback-assisted relaxation followed by 45 minutes of aerobic exercise on the alternative session.

To accommodate for the limited number of Ergometer exercise apparatus and EMG biofeedback instruments available at the Clinic and Center for Behavioral Medicine, and in order to enable the administering of the intervention on an individual basis, the experimental group was sub-divided into two groups of 7 subjects.

Group A received the intervention on a bi weekly basis, Mondays and Wednesdays.

Group B received the intervention on a bi weekly basis, Tuesdays and Thursdays.

The control group received an 8-week attention placebo procedure with an emphasis on the provision of information regarding HIV-seropositivity and the psychological and medical implications of the AIDS disease. More specifically, subjects of the control group received individual counseling sessions once a week, over the 8-week period, at the Hillbrow Hospital in Johannesburg, as part of the outpatient service offered to HIV-seropositive patients. The counselling sessions were of 20 minutes duration, and were primarily focused on information provision regarding the psychological and medical aspects of the AIDS disease, as well as sociocultural issues and the role of traditional healers in dealing with HIV infection. Medical issues discussed, were the non availability of a vaccine to prevent HIV infection or medication to cure it, the infections and associated diseases that these persons were likely to experience as a result of their infection, the issues of prevention against further transmission of the virus, and the use of antiviral medications for the later stages of HIV infection. From a psychological point, counselling was limited to information provision regarding likely effects that stress could have on their overall deteriaration, and the importance of active-coping approaches, although no such approaches were utilised, examples of such approaches were given to these patients. The control group was further given the opportunity to participate in a group-based aerobic exercise and cognitive-behavioral therapy program once the 8 week intervention had been completed by the experimental group and all psychological measures had been completed by both groups, at baseline and post intervention phases

2.4.1 AEROBIC EXERCISE

The Aerobic Exercise component of this intervention was done in 2 sections, A & B. Section A was composed of low to medium impact aerobic exercise classes of duration between 40 - 45 minutes. The main purpose of this section was to enhance Cardiovascular Fitness, Flexibility of joints, Muscular Fitness and general improvement in work performance, energy levels, and to strengthen bones, ligaments and tendons. This section was presented by a qualified exercise physiologist.

Section B was composed of aerobic exercise with a stationary bicycle ergometer. The frequency of exercise consisted of one supervised session per week, alternating with the aerobic exercise class on the alternative session. The intensity of training utilized between 70-80 % of maximum heart generation which is great enough to elicit a training effect. but not to great to be considered unsafe.

2.4.1.1 SECTION A: LOW TO MEDIUM IMPACT AEROBIC EXERCISE CLASS.

The main purpose of this section was to enhance Cardiovascular Fitness, Flexibility of joints, Muscular Fitness and General Improvement in work performance, energy levels, and to strengthen bones, ligaments and tendons. This section was presented by a qualified exercise physiologist and had the following structure:

2.4.1.1.1 Warm-Up Phase and General Preparation Phase

The function of this section was to prepare the body for the main conditioning phase of the class. Both major and minor muscle groups were "warmed up" with controlled, brisk, rhythmical movements. A warm-up should not exhaust participants but should increase blood flow and stimulate the cardiovascular system. Music played created a vibe which contributed towards an exciting and fun-filled atmosphere beneficial for the participants enjoyment and enhancement of mood. The probability was high that the participants at first would be unfit and have limited mobility and thus were guided through a carefully planed warm-up, ensuring that all joints were exercised through a wide range and variety of movements. Dynamic stretching also formed a part of the warm-up and consisted of controlled leg-lifts which gradually increased in height.

2.4.1.1.2 Main Conditioning Phase

This was the most important part of the class as vigorous movements provided the over-load needed for improvement. This section included both aerobic (O2 dependent) and strength components. Both low-impact activity and running, jumping, simple dance steps and controlled kicks were incorporated. The duration of this section was a minimum of 30 minutes, probably averaging between 35-45 minutes. To end off , another low-impact section of another 3-5 minutes was followed.

Carefully planned combinations were worked out for this main conditioning phase. The main conditioning phase consisted of combinations, varied movements, directional changes and strong arm movements. This formed the cardiovascular section of the work-out, especially during the first few sessions when the participants are still relatively unfit, the exercise was then only composed of approximately 30 - 45 minutes of low-impact activity, where jumping and running were excluded. Once the group had reached a low-high structure of aerobic fitness, the exercise was comprised of 5-10 minutes of low-impact combinations together with 5-10 minutes of high-impact combinations throughout the 35 - 45 minute main phase section. The main phase was rounded off with rhythmical moves or controlled squats and stretching.The last section of the main phase was for specific exercises, that is arm-exercises, abdominals, backs, buttocks and legs. These exercises made use of resistance throughgravity and also made use of elastics, sticks, balls and weights.

2.4.1.1.3 Cool-Down Phase or Concluding Phase

The main aim of this section was to return the body to a steady state and allow the participants to regain their breath and their equilibrium level. Rhythmical movements, flexibility and relaxation exercises were included whilst gradually moving the body into a standing position. Final objectives were to bring about a general improvement in health and enhance the activities of the immune system and thereby decelerate the progression of HIV related disease progression.

2.4.1.1.4 SECTION B: AEROBIC EXERCISE STATIONARY BICYCLE ERGOMETER SECTION.

The frequency of exercise training consisted of two supervised sessions per week while the intensity of the ergometer training utilized between 70-80% of maximum heart generation. An intensity of 70-80% was selected because it is great enough to elicit a training effect, but not to great to be considered unsafe.

The duration of the exercise training was for 45 minutes each session and comprised 10 minutes stretching before and after 45 minutes of aerobic training. The type of aerobic exercise training was an interval training protocol consisting of alternating periods of training intensity and relief intervals. The modality of exercise was stationary bicycle ergometry.

The subjects were provided with information pertaining to the exercise training. Subjects received directions on how to perform pre-and post-training stretching exercises for six separate muscle groups. This took approximately ten minutes to complete. Supervised one-on-one demonstration and evaluation on each stretch was given until the subject was proficient. The stretches were: calf stretch, hamstring stretch, lower back stretch, groin stretch, shoulder stretch, modified hurdler stretch.

The concept of interval training was explained to each subject. Interval training consists of alternating periods of exercise performed at higher and lower exercise intensities. The higher intensity period is termed the task period and is attained when the heart rate is within the subject's target heart rate zone. The heart rate was never allowed to exceed the upper limit setting on the heart rate monitor. Task periods lasted for three minutes.

The lower intensity period, termed the off task period is attained when the heart rate is below the lower limit setting of the heart rate monitor. Off task periods lasted for two minutes. The objective of interval training was to maintain the heart rate within the target heart rate zone during the task periods and for heart rate to be just below the target heart zone during the off task periods. The pedal speed throughout the interval training session was maintained at a constant sixty revolutions per minute. The changes in heart rate were achieved by increasing or decreasing the bicycle's tension control setting.

2.5 COGNITIVE- BEHAVIORAL THERAPY.

As this intervention was specifically aimed at reducing physiological tension, anxiety and depression, and in assisting in the psychological and social coping of HIV positive individuals in relation to mood and immune enhancement, each session had an umbrella topic which was the focus of that specific meeting. These main themes guided the therapeutic process in specific areas where deficits and short comings in social conventions and coping strategies existed, which contributed to an improved overall mood through an increase in self-esteem and social security as well as reductions in depression and physiological-tension.

2.5.1 STRUCTURE AND CONTENTS OF THE COGNITIVE-BEHAVIORAL THERAPY SESSIONS.

The Cognitive Behavioral Therapy sessions were made up of 3 components namely didactic aspects, cognitive techniques and behavioral techniques.
The experimental group received Cognitive-Behavioral Therapy every alternative session lasting approximately 45 minutes. This was followed by stationary bicycle ergometry lasting 45 minutes.

(1) Didactic aspects.

Didactic aspects, refer to the interaction of the client and therapist, where the therapist in part may assume a teacher-role clarifying the whole process of therapy.
For example, the cognitive triad was explained, which states that a negative self-perception lets a person feel defective, inadequate, deprived, worthless and undesirable. Tendencies exist to experience the world as negative, demanding , and as a self-defeating place and to expect failure and punishment. Furthermore, expectations of continued hardship, suffering, failure and deprivation exist. These are schemas and faulty logic contributing to negative self-image.

The therapist together with the patient formulated hypotheses and tested them over the course of the treatment. Cognitive-Behavioral therapy further required a full explanation of the relationship between the subjective discomfort and thinking, affect, behavior and the rationale for all aspects of treatment.

(2) Cognitive techniques.

The cognitive approach made use of four processes, ranging from identifying to making the client aware of the maladaptive or distorted aspects of their reasoning or adaptation.

The four processes used were as follows:
-Eliciting automatic thoughts (cognition's that intervene between external events and the persons emotional reaction to the event).

- Testing automatic thoughts (Here the therapist helped the patient test the validity of thoughts and encouraged rejection of inaccurate automatic thought and generated alternative explanations).

- Identifying maladaptive underlying assumptions (automatic thoughts were held constant by patterns which were represented by rules or maladaptive general assumptions leading to disappointments and failure).

- Testing the validity of maladaptive assumptions (an effective test was used to ask the patient to defend the validity of an assumption).

(3) Behavioral techniques.

Testing and changing maladaptive and inaccurate cognition's helped the patients understand the inaccuracies of their cognitive assumptions and through this, they learnt new strategies enabling them to cope and deal with situations which previously had been problematic and uncomfortable. Techniques which were used here focused on specific aspects such as imagery, efficacy and social coping.

2.6 EMG -BIOFEEDBACK ASSISTED RELAXATION TRAINING SESSIONS.

The 14 subjects in the experimental or treatment group received Electromyographic (EMG)-biofeedback-assisted relaxation training for a period of 8-weeks. Experimental subjects met on a biweekly basis for 1 hour and 30 minutes. They received 45 minutes of cognitive-behavioral therapy and 45 minutes of ergometric aerobic exercise in the one session and 20 minutes of EMG-feedback followed by 45 minutes of aerobic exercise on the alternative session. The biofeedback-assisted relaxation training sessions were conducted in a 4 by 6-metre room that was dimly lit during these training sessions. Patients were seated in a fully reclined position, in a recliner chair. The lights in the room were dimmed, and there were no surrounding noises to disturb the subject. Pillows were also used to provide support and comfort to the patient, and to assist the patient in recognizing a state of general relaxation. Silver chloride EMG electrodes were applied to the frontalis muscle of the forehead, after the patients forehead had been cleansed with alcohol. The conducting medium was Hewlet Packare Redux Paste.

Placement of electrodes was facilitated by having the patient raise his\ her eyebrows so that the experimenter could visualise the frontalis muscle, thereby allowing for individual differences to be noticed. An active recording electrode was placed above each pupil in the center of the forehead. Electromyographic-feedback was provided using the biofeedback instrument (EMG 100T, manufactured by Thought Technology), measuring in microvolts (mv) /rms. Feedback of the frontalis muscle activity was provided in an auditory form through a speaker placed near the patients right ear and consisted of a tone that pulsated at a steady rate while the volume of the tone varied in proportion to the EMG level. The EMG audio-feedback was initially turned to a very low volume, but when the subject reached a relaxed state, the audio was turned up slightly and the subject was allowed to monitor his or her own physiological state.

The biofeedback-assisted relaxation sessions, were made up of a 10-minute baseline assessment session, 5 twenty minute sessions, and a 10-minute follow-up session. EMG-biofeedback baseline assessments, included two 5-minute EMG baseline readings, preceeded by a 2-minute stabilisation period. The two 5-minute baseline readings were taken taken by instructing the subject to"Lie back, close your eyes and allow yourself to be as comfortable as you can. At the end of the 5-minute period, I will ask you to open your eyes, ending the five minute rest period." The same instructions were given for the second 5-minute baseline. The average of these two 5-minute baselines constituted the relaxation level. Included during the baseline evaluations was information and instuctions regarding the process and treatment success expectations of biofeedback.

Following the baseline assessment session, 1 twenty minute feedback-assisted relaxation session per week, for 5 weeks was conducted, with readings been taken at 5-minute intervals. The purpose of these treatment sessions was to train subjects to a specified criterion level. This level was EMG frontalis below 1.5 microvolts (integral average). Cassette relaxation tapes were used to assist the biofeedback-assisted relaxation process. These cassette relaxation tapes were pre-recorded. Side 1 of the tape was a 25-minute tense-relax relaxation exercise. Side 2 was a 20-minute passive or progressive mental relaxation exercise. Both exercises were designed by the experimenter.

Subjects were given the cassette tape following the first session. They were instructed to listen to Side 1 of the tape, at least once daily preferably in the evening, for 1 week. The 2nd week, they were instructed to listen to Side 2 at least once daily, again preferably in the evening for 1 week. Thereafter, they were told to choose which side of the tape they felt more comfortable with or preferred, and to practice 20 minutes of relaxation on their own, without the assistance of the EMG instruments.

After completion of the 5-week EMG biofeedback-assisted relaxation training, subjects were again assessed at a 6-week follow-up phase. During this 6-week follow-up phase, the ability of the subjects to relax without the assistance of the feedback equipment was assessed. More specifically, after a 2-minute stabilization period, EMG activity of the frontalis was recorded for 10-minutes, and an overall single mean value for each subject was obtained. This 10-minute session did not allow patients to utilise the assistance of the biofeedback equipment. This was done, in order to assess the subjects ability to relax and voluntarily control their own physiological tension levels. The above method utilized for this study, was recommended by Schwartz & associates (1987).

2.7 EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS.

For the purpose of this research, a pre-test, post-test, experimental and control group design with immune lymphocyte subsets and psychophysiological assessment of depression, tension-anxiety, vigor and fatigue levels as the primary dependent variables, was used. A baseline measurement was taken prior to the intervention, followed by post-test measurements once the intervention had been completed. The baseline or pre-test measures provided information regarding the equality of the groups prior to the administration of the experimental treatment, concerning the behavioral change that was desired to be modified or changed by the intervention. The post-test measurements provided information regarding the effects of the experimental intervention on the experimental group as compared to those achieved by the waiting list control group.

Analysis of variance with specific post hoc analysis was utilized to analyze the data. For the computation of t, for a two independent groups design the t-test was used after the dependent-variable values for the two groups were known to test the null hypothesis.

CHAPTER THREE

RESULTS

3.1 INTRODUCTION

Numerous studies have thus far documented the shortcomings of biomedical interventions in treating persons infected with the Human immunodeficiency virus (HIV). At this point in time, biomedical treatment of patients seropositive for the HIV or already suffering from Acquired immunodeficiency Syndrome (AIDS), is limited to management of the symptoms and possible prolonging of life and functionality (Levinson & Jawetz, 1994 & Wolff et al., 1996).

It has also become well-known that the need and treatment of HIV-seropositive patients in South-Africa, will outstrip the presently available health resources to such an extent, that it could destroy the social infrastructure of this country (Epidemiological comments, 1995).

In South-Africa, the HIV\ AIDS situation is further compounded by a number of social and economic factors, in a society expressing rapid political changes, against a background of apartheid. Herein, issues of poverty, violence, proper medical care for HIV sufferers, especially in the rural areas where antiviral medications and other health services are not easily accessible, inadequate housing and unemployment, place even greater burdens on the already under-served HIV sufferer. With the above aspects in mind, and considering the seriousness of the AIDS pandemic in South-Africa as well as the absence of effective pharmacological agents in curing this disease, an 8-week combined biopsychosocial treatment intervention utilizing individualised cognitive-behavioral therapy, aerobic exercise and Electromyographic-feedback was developed.

The objective of this intervention was to serve as an adjunctive treatment method to the presently available pharmacological treatments, especially during the asymptomatic and early symptomatic stages of HIV-infection, where the apparent sluggishness of immunological functioning may be most amenable to interventions that enhance effector functions and communication between CD4 T-lymphocytes, CD8 T-lymphocytes, macrophages and B cells via increases in lymphokine production.
The intervention further aimed to decrease depression, physiological tension-anxiety and fatigue-inertia levels, as well as increase vigor-activity levels important in the overall health status of HIV-seropositive patients.

The specific Research Hypotheses for this study were:

(1) There would be greater increases in the total lymphocyte and CD4 T-cell mediated immune counts, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and Electromyographic (EMG)-feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

(2) There would be greater clinical improvements in the CD4:CD8 T-lymphocyte cell ratio, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then
in subjects of the control group, who only received an attention placebo procedure.

3a) There would be greater decreases in depression levels, as measured by the Beck Depression Inventory (B D I) and the Profile of Mood States (POMS) factor D, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

3b) There would be greater decreases in tension-anxiety levels, as measured by the POMS factor T, and decreases in EMG -physiological tension levels, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG-feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

3c) There would be greater decreases in fatigue-inertia levels, as measured by the POMS factor F, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

(4) There would be greater increases in Vigor-activity levels, as measured by the POMS factor V, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

In order to perform this study, 26 subjects from a larger Hillbrow Hospital AIDS out-patient population of (N=98), who fitted the inclusion criteria for participation in the study, were selected and randomly divided into an experimental group, (n=14) and waiting list control group, (n=12). More specifically, subjects were either asymptomatic or early symptomatic HIV-seropositives with baseline recordings of CD4-T lymphocytes of above 200, (CDC stages 2-3 and WR stages 2-4A, see inclusion criteria in chapter 2 under section 2.2.3).

The experimental group was subjected to a combined 8-week individualised biopsychosocial treatment intervention, composed of cognitive-behavioral therapy, electromyographic-feedback assisted relaxation training and ergometric aerobic activity.

The control group received an 8-week attention placebo procedure with an emphasis on the provision of information regarding HIV-seropositivity and the psychological and medical implications of the AIDS disease. More specifically, subjects of the control group received individual counseling sessions once a week, over the 8-week period, at the Hillbrow Hospital in Johannesburg, as part of the outpatient service offered to HIV-seropositive patients. The counselling sessions were of 20 minutes duration, and were primarily focused on information provision regarding the psychological and medical aspects of the AIDS disease, as well as sociocultural issues and the role of traditional healers in dealing with HIV infection. Medical issues discussed, were the non availability of a vaccine to prevent HIV infection or medication to cure it, the infections and associated diseases that these persons were likely to experience as a result of their infection, the issues of prevention against further transmission of the virus, and the use of antiviral medications for the later stages of HIV infection. From a psychological point, counselling was limited to information provision regarding likely effects that stress could have on their overall deteriaration, and the importance of active-coping approaches, although no such approaches were utilised, examples of such approaches were given to these patients. The control group was further given the opportunity to participate in a group-based aerobic exercise and cognitive-behavioral therapy program once the 8 week intervention had been completed by the experimental group and all psychological measures had been completed by both groups, at baseline and post intervention phases

In this chapter, the results of the combined biopsychosocial treatment intervention in terms of the differences between pre-test measures and post-test measures of selected psychological and immunological parameters, as well as differences in the post-test measures between the group exposed to the experimental intervention and the control group is discussed. Subsequent to this, the relationships between selected immunological and psychological variables are discussed. Following the above inferential statistical analysis, a descriptive statistical analysis of the EMG-feedback assisted relaxation training effects on experimental subjects is discussed.

3.2 INFERENTIAL STATISTICAL ANALYSIS OF RESEARCH DATA

3.2.1 SIGNIFICANCE OF DIFFERENCES BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS ON BASELINE MEASURES

INTRODUCTION

In order to determine the significance of differences between the experimental and waiting list control group, on baseline measures of immunological and psychological functioning, t-tests were conducted on these measures. More specifically, cell-mediated immune measures included, total lymphocyte counts, CD4-T lymphocyte counts, CD8-T lymphocyte counts as well as CD4:CD8-T lymphocyte ratios.

Psychological measures included the profile of mood states (POMS) factors, T (Tension Anxiety), D (Depression-Dejection), V(Vigor- Activity) and F (Fatigue-Inertia), and depression using the Beck Depression Inventory (B D I).

3.2.1.1 SIGNIFICANCE OF DIFFERENCES BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS ON BASELINE MEASURES OF IMMUNOLOGICAL VARIABLES.

t-tests conducted in order to determine the significance of differences between the experimental and control groups on baseline measures of total lymphocyte counts, as well as CD4, CD8 and CD4:CD8 ratio T-lymphocyte counts, indicated no significant differences ($P > 0.05$), (see table 3.1).

Table 3.1 Significance of differences between experimental and control groups on baseline measures of immunological variables

Variable	Means Experimental Group	Means Control Group	t - Value	df	p
Lymphocytes	1.591	1.812	-1.09	22	p>0.05
CD4 T-cells	0.405	0.478	-1.16	23	p>0.05
CD8 T-cells	0.692	0.825	-0.73	24	p>0.05
CD4:CD8 ratio	0.950	0.898	0.17	24	p>0.05

p = 0.05* CD4 T-cells = T-Helper / inducer cells

p = 0.01* CD8 T-cells = T-Suppresser cells

p = 0.001*** CD4:CD8 ratio = Helper : Suppresser ratio

3.2.1.2 SIGNIFICANCE OF DIFFERENCES BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS ON BASELINE MEASURES OF PSYCHOLOGICAL VARIABLES.

t-tests conducted in order to determine the significance of differences between baseline measures of Profile of mood states (POMS) factor T (Tension-Anxiety), as well as factor D (Depression-dejection), factor V (Vigor-Activity), factor F (Fatigue-Inertia), and the Beck Depression Inventory (B D I), indicated no significant differences (P> 0.05), (see table 3.2).

Table 3.2 Significance of differences between experimental and control groups on baseline measures of psychological variables

Variable	Means Experimental Group	Means Control Group	t - Value	df	p
POMS factor T	21.28	22.83	-0.96	22	p>0.05
POMS factor D	36.07	37.09	-0.26	23	p>0.05
POMS factor V	10.00	9.58	0.47	24	p>0.05
POMS factor F	21.86	22.75	-0.73	20	p>0.05
B.D. Inv	38.36	38.58	-0.05	24	p>0.05

p = 0.05* POMS T = FACTOR TENSION- ANXIETY

p = 0.01* POMS D = FACTOR DEPRESSION- DEJECTION

p = 0.001*** POMS V = FACTOR VIGOR- ACTIVITY

POMS F = FATIGUE-INERTIA

B D INV = BECK DEPRESSION INVENTORY

3.2.2 SIGNIFICANCE OF DIFFERENCES BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS ON POST-TEST MEASURES OF VARIABLES

INTRODUCTION

In order to determine the significance of differences between the experimental and waiting list control group, on post-test measures of immunological and psychological functioning, t-tests were conducted on these measures. More specifically, cell-mediated immune measures included, total lymphocyte counts, CD4-T lymphocyte counts, CD8-T lymphocyte counts as well as CD4:CD8-T lymphocyte ratios.
Psychological measures included, the profile of mood states (POMS) factors, T (Tension Anxiety), D (Depression-Dejection), V(Vigor- Activity) and F (Fatigue-Inertia), and depression using the Beck Depression Inventory (B D I).

3.2.2.1 SIGNIFICANCE OF DIFFERENCES BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS ON POST-TEST MEASURES OF IMMUNOLOGICAL VARIABLES

t-tests conducted in order to determine the significance of differences between the experimental and control groups on post-test measures of total lymphocyte counts, as well as CD4, CD8 and CD4:CD8 ratio T-lymphocyte counts, indicated no significant differences (P> 0.05), (see table 3.3).

Table 3.3 Significance of differences between the experimental and control group on post-test measures of immunological variables.

Variable	Means Experimental Group	Means Control Group	t - Value	df	p
Lymphocytes	2.17	1.78	1.22	17	p>0.05
CD4 T-cells	0.436	0.442	-0.09	20	p>0.05
CD8 T-cells	0.912	0.791	0.52	20	p>0.05
CD4:CD8 ratio	0.779	0.797	-0.06	23	p>0.05

p 0.05* CD4 T-cells = T-Helper / inducer cells
p 0.01* CD8 T-cells = T-Suppresser cells
p 0.001*** CD4:CD8 ratio = Helper : Suppresser ratio

3.2.2.2 SIGNIFICANCE OF DIFFERENCES BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS ON POST-TEST MEASURES OF PSYCHOLOGICAL VARIABLES

A t-test conducted in order to determine the significance of differences between the experimental and control group on post-test measures of POMS factor T (Tension-Anxiety), indicated a significant difference ($P< 0.01$), (see table 3.4). The significant difference indicated that post-test levels of POMS factor Tension-Anxiety were lower, mean ($x = 17.42$), for the experimental group, than post-test measures of POMS factor Tension-Anxiety, mean ($x = 22.75$), for the control group, (see table 3.4).

A t-test conducted in order to determine the significance of differences between the experimental and control group on post-test measures of POMS factor D (Depression-Dejection), indicated a significant difference ($P< 0.01$), (see table 3.4). The significant difference indicated that post-test levels of POMS factor Depression-Dejection were lower, mean ($x = 25.28$), for the experimental group, than post-test measures of POMS factor Depression-Dejection, mean ($x = 36.75$), for the control group, (see table 3.4).

A t-test conducted in order to determine the significance of differences between the experimental and control group on post-test measures of POMS factor F (Fatigue-Inertia), indicated a significant difference ($P< 0.01$), (see table 3.4). The significant difference indicated that post-test levels of POMS factor Fatigue-Inertia were lower, mean ($x = 17.10$), for the experimental group, than post-test measures of POMS factor Fatigue-Inertia, mean ($x = 22.34$), for the control group, (see table 3.4).

Table 3.4 Significance of differences between the experimental and control group on post-test measures of psychological variables.

Variable	Means Experimental Group	Means Control Group	t - Value	df	p
POMS factor T	17.42	22.75	-3.54	21	p<0.01**
POMS factor D	25.28	36.75	-3.38	19	p<0.01**
POMS factor V	12.78	10.34	3.07	20	p<0.01**
POMS factor F	17.10	22.34	-3.93	18	p<0.01**
B.D. Inv	23.78	36.84	-2.54	23	p<0.05*

p : 0.05*
p : 0.01*
p : 0.001***

POMS T = FACTOR TENSION- ANXIETY
POMS D = FACTOR DEPRESSION- DEJECTION
POMS V = FACTOR VIGOR- ACTIVITY
POMS F = FACTOR FATIGUE- INERTIA
B.D.INV = BECK DEPRESSION INVENTORY

A t-test conducted in order to determine the significance of differences between the experimental and control group on post-test measures of POMS factor V (Vigor-Activity), indicated a significant difference (P< 0.01), (see table 3.4).
The significant difference indicated that post-test levels of POMS factor Vigor-Activity were higher, mean (x = 12.78), for the experimental group, than post-test measures of POMS factor Vigor-Activity, mean (x = 10.34), for the control group, (see table 3.4).

A t-test conducted in order to determine the significance of differences between the experimental and control group on post-test measures of the Beck Depression Inventory, (BDI) indicated a significant difference (P< 0.05), (see table 3.4).
The significant difference indicated that post-test levels of the BDI were lower, mean (x = 23.78), for the experimental group, than post-test measures of the BDI, mean (x = 36.84), for the control group, (see table 3.4).

3.2.3 DIFFERENCES IN IMMUNOLOGICAL AND PSYCHOLOGICAL FUNCTIONING DUE TO THE EXPERIMENTAL INTERVENTION

INTRODUCTION

t-tests were conducted in order to determine the significance of differences between baseline and post-test measures of immunological and psychological functioning. Immunological measures included, total lymphocyte, CD4-T lymphocyte, CD8-T lymphocyte as well as CD4:CD8-T lymphocyte ratio counts.

Psychological measures included, the profile of mood states (POMS) factors, T (Tension-Anxiety), D (Depression-Dejection), V (Vigor-Activity) and F (Fatigue-Inertia), and depression, using the Beck Depression Inventory.

3.2.3.1 SIGNIFICANCE OF DIFFERENCES BETWEEN BASELINE AND POST-TEST MEASURES FOR THE ASSESSMENT OF IMMUNOLOGICAL VARIABLES IN EXPERIMENTAL SUBJECTS

In order to determine the significance of differences between baseline and post-test measures of total lymphocyte counts, a t-test was conducted. The t-test indicated a significant difference, ($p < 0.05$), (see table 3.5), in that post-test measures of total lymphocyte counts were higher, mean ($x = 2.170$), than baseline measures of total lymphocyte counts mean ($x = 1.591$), for the experimental subjects.

Table 3.5 Significance of differences between pre and post-tests for the assessment of immunological variables for experimental subjects

Variable	Pre-test Mean Value	Post-test Mean Value	t - Value	df	p
Lymphocytes	1.591	2.170	2.80	13	p<0.05*
CD4 T-cells	0.405	0.436	1.30	13	p>0.05
CD8 T-cells	0.692	0.912	1.64	13	p>0.05
CD4:CD8 ratio	0.950	0.779	-1.79	13	p>0.05

p 0.05* CD4 T-cells = T-Helper / inducer cells

p 0.01* CD8 T-cells = T-Suppresser cells

p 0.001*** CD4:CD8 ratio = Helper : Suppresser ratio

t-tests conducted in order to determine the significance of differences between the baseline and post-test measures of CD4, CD8 and CD4:CD8 ratio T-lymphocyte counts, for subjects in the experimental group, indicated no significant differences (P> 0.05), (see table 3.5).

3.2.3.2 SIGNIFICANCE OF DIFFERENCES BETWEEN BASELINE AND POST-TEST MEASURES FOR THE ASSESSMENT OF PSYCHOLOGICAL VARIABLES IN EXPERIMENTAL SUBJECTS

A t-test conducted in order to determine the significance of differences between baseline and post-test measures of POMS factor T (Tension-Anxiety), indicated a significant difference ($p < 0.001$), (see table 3.6). The significant difference indicated that post-test measures of POMS factor T were lower, mean ($x = 17.42$), than baseline measures, mean ($x = 21.28$) for the experimental subjects, (see table 3.6).

A t-test conducted in order to determine the significance of differences between baseline and post-test measures of POMS factor D (Depression-Dejection), indicated a significant difference ($p < 0.001$), (see table 3.6). The significant difference indicated that post-test measures of POMS factor D were lower, mean ($x = 25.28$), than baseline measures, mean ($x = 36.07$) for the experimental subjects, (see table 3.6).

A t-test conducted in order to determine the significance of differences between baseline and post-test measures of POMS factor F (Fatigue-Inertia), indicated a significant difference ($p < 0.001$), (see table 3.6). The significant difference indicated that post-test measures of POMS factor F were lower, ($x = 17.10$), than baseline measures, mean ($x = 21.86$) for the experimental subjects, (see table 3.6).

Table 3.6 Significance of differences between pre and post-tests for the assessment of psychological variables for experimental subjects

Variable	Pre-test Mean Value	Post-test Mean Value	t - Value	df	p
POMS factor T	21.28	17.42	-4.84	13	p<0.01**
POMS factor D	36.07	25.28	-4.63	13	p<0.01**
POMS factor V	10.00	12.78	4.30	13	p<0.01**
POMS factor F	21.86	17.10	-7.03	13	p<0.01**
B.D. Inv	38.36	23.78	-5.2	13	p<0.05*

$p < 0.05$*
$p < 0.01$**
$p < 0.001$***

POMS T = FACTOR TENSION- ANXIETY
POMS D = FACTOR DEPRESSION- DEJECTION
POMS V = FACTOR VIGOR- ACTIVITY
POMS F = FACTOR FATIGUE- INERTIA
B.D.INV = BECK DEPRESSION INVENTORY

A t-test conducted in order to determine the significance of differences between baseline and post-test measures of POMS factor V (Vigor-Activity), indicated a significant difference ($p < 0.001$). (see table 3.6). The significant difference indicated that post-test measures of POMS factor V were higher, mean ($x = 12.78$), than baseline measures, mean ($x = 10.00$) for the experimental subjects. (see table 3.6).

A t-test conducted in order to determine the significance of differences between baseline and post-test measures of the Beck Depression Inventory, indicated a significant difference ($p < 0.001$). (see table 3.6). The significant difference indicated that post-test measures of BDI were lower, mean ($x = 23.78$), than baseline measures, mean ($x = 38.36$) for the experimental subjects, (see table 3.6).

3.2.3.3 SIGNIFICANCE OF DIFFERENCES BETWEEN BASELINE AND POST-TEST MEASURES FOR THE ASSESSMENT OF IMMUNOLOGICAL VARIABLES IN SUBJECTS OF THE CONTROL GROUP

t-tests conducted in order to determine the significance of differences between baseline and post-test measures of total lymphocyte, CD4, CD8 and CD4:CD8 ratio

T- lymphocyte counts, in subjects of the control group, indicated no significant differences ($p > 0.05$), (see table 3.7).

Table 3.7 Significance of differences between baseline and post-tests for assessment of immunological variables in subjects of the control group

Variable	Pre-test Mean Value	Post-test Mean Value	t - Value	df	p
Lymphocytes	1.812	1.780	-0.46	11	p>0.05
CD4 T-cells	0.478	0.442	-1.77	11	p>0.05
CD8 T-cells	0.825	0.791	-0.38	11	p>0.05
CD4:CD8 ratio	0.898	0.797	-1.24	11	p>0.05

p = 0.05* CD4 T-cells = T-Helper / inducer cells

p = 0.01* CD8 T-cells = T-Suppresser cells

p = 0.001*** CD4:CD8 ratio = Helper : Suppresser ratio

3.2.3.4 SIGNIFICANCE OF DIFFERENCES BETWEEN BASELINE AND POST-TEST MEASURES FOR THE ASSESSMENT OF PSYCHOLOGICAL VARIABLES IN SUBJECTS OF THE CONTROL GROUP

t-tests conducted in order to determine the significance of differences between baseline and post-test measures of POMS factor T, D, F and the Beck Depression Inventory, for subjects in the control group, indicated no significant differences ($p > 0.05$), (see table 3.8).

Table 3.8 Significance of differences between baseline and post-tests for assessment of psychological variables in subjects of the control group

Variable	Pre-test Mean Value	Post-test Mean Value	t - Value	df	p
POMS factor T	22.83	22.75	-0.10	11	p>0.05
POMS factor D	37.09	36.75	-0.19	11	p>0.05
POMS factor V	9.58	10.34	2.28	11	p<0.05*
POMS factor F	22.75	22.34	-0.59	11	p>0.05
B.D. Inv	38.58	36.84	-0.61	11	p>0.05

$p < 0.05$*
$p < 0.01$*
$p < 0.001$***

POMS T = FACTOR TENSION- ANXIETY
POMS D = FACTOR DEPRESSION- DEJECTION
POMS V = FACTOR VIGOR- ACTIVITY
POMS F = FACTOR FATIGUE- INERTIA
B.D.INV = BECK DEPRESSION INVENTORY

A t-test conducted in order to determine the significance of differences between baseline and post-test measures of POMS factor V (Vigor-Activity), in subjects of the control group, indicated a significant difference ($p < 0.05$), (see table 3.8). The significant difference indicated that post-test measures of POMS factor V were higher, mean ($x = 10.34$), than baseline measures, mean ($x = 9.58$) for the control subjects.

3.2.5 INTERRELATIONSHIPS BETWEEN PSYCHOLOGICAL AND IMMUNOLOGICAL VARIABLES

INTRODUCTION

In order to determine the relationships between psychological and immunological measures, intercorrelation matrices were constructed, wherein the relationships between the immune subsets, namely, total lymphocytes, CD4-T lymphocytes, CD8-T lymphocytes and CD4:CD8-T lymphocyte ratios, and the psychological measures namely, POMS factors T (Tension-Anxiety), D (Depression-Dejection), V (Vigor-Activity) and F (Fatigue-Inertia) and the Beck Depression Inventory (B D I), were analyzed.

3.2.5.1 RELATIONSHIPS BETWEEN PSYCHOLOGICAL AND IMMUNOLOGICAL VARIABLES ON BASELINE MEASURES.

3.2.5.1.1 RELATIONSHIPS BETWEEN PSYCHOLOGICAL AND IMMUNOLOGICAL VARIABLES ON BASELINE MEASURES FOR SUBJECTS IN THE EXPERIMENTAL GROUP.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for the experimental group, a significant negative correlation was found between POMS factor D (Depression-Dejection) and total lymphocyte counts ($r = -0.7322$, $p < 0.01$), (see table 3.9). The significant negative correlation indicated, that the higher the baseline depression levels, as measured by POMS factor D, of the experimental subjects, the lower the total lymphocyte counts were.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for the experimental group, a significant negative correlation was found between POMS factor D (Depression-Dejection) and CD4-T lymphocyte counts ($r = -0.9278$, $p < 0.01$), (see table 3.9). The significant negative correlation indicated, that the higher the baseline depression levels, as measured by POMS factor D, of the experimental subjects, the lower the CD4-T lymphocyte counts were.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for the experimental group, a significant negative correlation was found between POMS factor T (Tension-Anxiety) and CD4-T lymphocyte counts ($r = -0.5496$, $p < 0.05$), (see table 3.9). The significant negative correlation indicated, that the higher the baseline Tension-Anxiety levels, as measured by POMS factor T, of the experimental subjects, the lower the CD4-T lymphocyte counts were.

Table 3.9 Intercorrelation matrix for psychological and immunological variables on baseline measures for the experimental group

	POMS T 1e	POMS D 1e	POMS V 1e	POMS F 1e	B.D.I. 1e
Lymphocytes 1e	-0.2620	-0.7322**	-0.3885	0.3293	-0.4920
CD4 1e	-0.5496*	-0.9278**	-0.1202	0.0863	-0.7656**
CD8 1e	-0.0661	-0.2465	-0.4061	0.3161	-0.1610
CD4:CD8 Ratio 1e	-0.0500	-0.4278	0.3758	-0.0427	-0.1418

p = 0.05*

p = 0.01**

p = 0.001***

Lymphocytes 1e = Baseline lymphocytes for experimental group

CD4 T-cells 1e = Baseline T-Helper / inducer cells for experimental group

CD8 T-cells 1e = Baseline T-Suppresser cells for experimental group

CD4:CD8 ratio 1e = Baseline Helper : Suppresser ratio for experimental group

POMS T 1e= Baseline factor Tension - Anxiety for experimental group

POMS D 1e = Baseline factor Depression -Dejection for experimental group

POMS V 1e =Baseline factor Vigor - Activity for experimental group

POMS F 1e = Baseline factor Fatigue -Inertia for experimental group

B.D.INV 1e = Baseline Beck Depression Inventory for experimental group.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for the experimental group, a significant negative correlation was found between the Beck Depression Inventory (BDI) and CD4-T lymphocyte counts ($r = -0.7656$, $p < 0.01$), (see table 3.9). The significant negative correlation indicated, that the higher the baseline depression levels, as measured by the (BDI), of the experimental subjects, the lower the CD4-T lymphocyte counts were.

3.2.5.1.2 RELATIONSHIPS BETWEEN PSYCHOLOGICAL AND IMMUNOLOGICAL VARIABLES ON BASELINE MEASURES FOR SUBJECTS IN THE CONTROL GROUP.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for the control group, no significant correlations were found between any of the variables, (see table 3.10).

Table 3.10 Intercorrelation matrix for psychological and immunological variables on baseline measures for the control group

	POMS T 1c	POMS D 1c	POMS V lc	POMS F lc	B.D.I. 1c
Lymphocytes 1c	0.0539	-02576	-0.0359	-0.0533	-0.2555
CD4 1c	-0.0887	-0.2491	-0.1642	-0.2299	-0.3300
CD8 1c	-0.2447	-0.3387	0.1307	-0.0746	-0.1552
CD4:CD8 Ratio 1c	0.4427	0.3197	0.0026	-0.0367	0.2643

p · 0.05*

p 0.01*

p · 0.001***

Lymphocytes 1c = Baseline lymphocytes for control group

CD4 T-cells 1c = Baseline T-Helper / inducer cells for control group

CD8 T-cells 1c = Baseline T-Suppresser cells for control group

CD4:CD8 ratio 1c = Baseline Helper : Suppresser ratio for control group

POMS T 1c= Baseline factor Tension - Anxiety for control group

POMS D 1c = Baseline factor Depression -Dejection for control group

POMS V 1c =Baseline factor Vigor - Activity for control group

POMS F 1c = Baseline factor Fatigue -Inertia for control group

B.D.INV 1c = Baseline Beck Depression Inventory for control group.

3.2.5.2 RELATIONSHIPS BETWEEN PSYCHOLOGICAL AND IMMUNOLOGICAL VARIABLES IN THE GROUPS POST TO THE EXPERIMENTAL INTERVENTION.

3.2.5.2.1 RELATIONSHIPS BETWEEN PSYCHOLOGICAL AND IMMUNOLOGICAL VARIABLES ON POST-EXPERIMENTAL MEASURES FOR SUBJECTS IN THE EXPERIMENTAL GROUP.

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for the experimental group, a significant negative correlation was found between POMS factor D (Depression-Dejection) and CD4-T lymphocyte counts ($r = -0.7344$, $p < 0.01$), (see table 3.11). The significant negative correlation indicated, that the lower the post-test depression levels were, as measured by POMS factor D, of the experimental subjects, the higher the CD4-T lymphocyte counts were.

Table 3.11 Intercorrelation matrix for psychological and immunological variables on post-test measures for the experimental group

	POMS T 2e	POMS D 2e	POMS V 2e	POMS F 2e	B.D.I. 2e
Lymphocytes 2e	-0.0318	-0.3638	0.2535	-0.0729	-0.3559
CD4 2e	-0.4365	-0.7374**	0.2727	-0.3027	-0.3749
CD8 2e	-0.0836	-0.0461	0.0467	0.0493	-0.2980
CD4:CD8 Ratio 2e	0.2592	-0.1006	0.0135	-0.0543	0.2628

p = 0.05*

p = 0.01*

p = 0.001***

Lymphocytes 2e = Post-intervention lymphocytes for experimental group

CD4 T-cells 2e = Post-intervention T-Helper / inducer cells for experimental group

CD8 T-cells 2e = Post-intervention T-Suppresser cells for experimental group

CD4:CD8 ratio 2e = Post-intervention Helper : Suppresser ratio for experimental group

POMS T 2e= Post-intervention factor Tension - Anxiety for experimental group

POMS D 2e = Post-intervention factor Depression -Dejection for experimental group

POMS V 2e = Post-intervention factor Vigor - Activity for experimental group

POMS F 2e = Post-intervention factor Fatigue -Inertia for experimental group

B.D.INV 2e = Post-intervention Beck Depression Inventory for experimental group.

3.2.5.2.2 RELATIONSHIPS BETWEEN PSYCHOLOGICAL AND IMMUNOLOGICAL VARIABLES ON POST-EXPERIMENTAL MEASURES FOR SUBJECTS IN THE CONTROL GROUP.

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for the control group, no significant correlations were found between any of the variables, (see table 3.12).

Table 3.12 Intercorrelation matrix for psychological and immunological variables on post-test measures for the control group

	POMS T 2c	POMS D 2c	POMS V 2c	POMS F 2c	B.D.I. 2c
Lymphocytes 2c	-0.1636	-0.2789	-0.3472	0.1718	-0.3482
CD4 2c	-0.3633	-0.3038	-0.3558	-0.0539	-0.3669
CD8 2c	-0.2297	-0.2645	-0.1462	-0.0703	-0.4348
CD4:CD8 Ratio 2c	0.1955	0.1404	0.0696	-0.0529	0.3003

p = 0.05*

p = 0.01*

p = 0.001***

Lymphocytes 2c = Post-intervention lymphocytes for control group

CD4 T-cells 2c = Post-intervention T-Helper / inducer cells for control group

CD8 T-cells 2c = Post-intervention T-Suppresser cells for control group

CD4:CD8 ratio 2c = Post-intervention Helper : Suppresser ratio for control group

POMS T 2c= Post-intervention factor Tension - Anxiety for control group

POMS D 2c = Post-intervention factor Depression -Dejection for control group

POMS V 2c = Post-intervention factor Vigor - Activity for control group

POMS F 2c = Post-intervention factor Fatigue -Inertia for control group

B.D.INV 2c = Post-intervention Beck Depression Inventory for control group.

3.2.6 RELATIONSHIPS BETWEEN PSYCHOLOGICAL AND IMMUNOLOGICAL VARIABLES ON BASELINE MEASURES FOR ALL CASES.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for all cases, a significant negative correlation was found between the Beck Depression Inventory and total lymphocyte counts ($r = -0.3934$, $p < 0.01$),(see table 3.13). The significant negative correlation indicated, that the higher the baseline levels of depression were as measured by the (BDI), the lower the total lymphocyte counts were.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for all cases, a significant negative correlation was found between the CD4:CD8-T lymphocyte ratio and CD4-T lymphocyte counts ($r = -0.6704$, $p < 0.01$), (see table 3.13). The significant negative correlation indicated, that the higher the baseline levels of CD8-T lymphocytes were, the lower the CD4:CD8-T lymphocyte ratio was.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for all cases, a significant positive correlation was found between POMS factor Tension-Anxiety and POMS factor Depression-Dejection ($r = 0.6166$, $p < 0.01$), (see table 3.13). The significant positive correlation indicated, that the higher the baseline levels of Tension-Anxiety were, the higher the levels of Depression-dejection were.

Table 3.13 Intercorrelation matrix for psychological and immunological variables on baseline measures for all cases

	Lympho	CD4	CD8	Ratio	POMS T	D	V	F	B.D.I.
CD4	0.7433	1.0000	-0.0395	0.4521*	-0.3004	-0.6416	-01504	0.0488	-0.5864
CD8	0.4300	-0.0395	1.0000	-0.6704**	-0.1148	-0.2748	-0.2115	0.2185	-0.1553
Ratio	0.01073	0.4521	-0.6704	1.0000	0.1419	-0.1387	0.2510	-0.0449	0.0109
POMS T	-0.0944	-0.3004	-0.1148	0.1419	1.0000	0.6166**	0.0044	0.3827	0.6604**
D	-0.5318**	-0.6416**	-0.2748	-0.1387	0.6166**	1.0000	-0.0404	0.0818	0.7843**
V	-0.2952	-0.1504	-0.2115	0.2510	-0.0044	-0.0404	1.0000	-0.4539*	0.0965
F	0.2735	0.0488	0.2185	-0.0449	0.3827	0.0818	-0.4539	1.0000	0.0703
BDI	-0.3934*	-0.5864**	-0.1553	0.0109	0.6604	0.7843	0.0965	0.0703	1.0000

p · 0.05*

p · 0.01**

p · 0.001***

Lympho = Baseline lymphocytes for all cases

CD4 T-cells = Baseline T-Helper / inducer cells for all cases

CD8 T-cells = Baseline T-Suppresser cells for all cases

CD4:CD8 ratio = Baseline Helper : Suppresser ratio for all cases

POMS T = Baseline factor Tension - Anxiety for all cases

POMS D = Baseline factor Depression -Dejection for all cases

POMS V =Baseline factor Vigor - Activity for all cases

POMS F = Baseline factor Fatigue -Inertia for all case

BDI = Baseline Beck Depression Inventory for all cases

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for all cases, a significant positive correlation was found between POMS factor Tension-Anxiety and the Beck Depression Inventory, (BDI) ($r = 0.6604$, $p < 0.01$), (see table 3.13). The significant positive correlation indicated, that the higher the baseline levels of Tension-Anxiety were, the higher the levels of Depression were, as measured by the (BDI).

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for all cases, a significant negative correlation was found between POMS factor Depression-Dejection and total lymphocyte counts ($r = -0.5318$, $p < 0.01$), (see table 3.13). The significant negative correlation indicated, that the higher the baseline levels of Depression-Dejection were, the lower the levels of total lymphocytes were.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for all cases, a significant negative correlation was found between POMS factor Depression-Dejection and CD4-T lymphocyte counts ($r = -0.6416$, $p < 0.01$), (see table 3.13). The significant negative correlation indicated, that the higher the baseline levels of Depression-Dejection were, the lower the levels of CD4-T lymphocytes were.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for all cases, a significant positive correlation was found between POMS factor Depression-Dejection and the Beck Depression Inventory (BDI)
($r = 0.7843$, $p < 0.01$), (see table 3.13). The significant positive correlation indicated, that the higher the baseline levels of Depression-Dejection were, the higher the levels of depression were as measured by the (BDI).

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for all cases, a significant negative correlation was found between POMS factor Vigor-Activity and POMS factor Fatigue-Inertia ($r = -0.4539$, $p < 0.05$),(see table 3.13). The significant negative correlation indicated, that the higher the baseline levels of Vigor-Activity were, the lower the levels of Fatigue-Inertia were.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for all cases, a significant negative correlation was found between the Beck Depression Inventory and total lymphocyte counts ($r = -0.3934$, $p < 0.05$), (see table 3.13). The significant negative correlation indicated, that the higher the baseline levels of depression were as measured by the (BDI), the lower the total lymphocyte counts were.

In an intercorrelation matrix for the psychological and immunological variables on baseline measures for all cases, a significant negative correlation was found between the Beck Depression Inventory and the CD4-T lymphocyte counts ($r = -0.5864$, $p < 0.01$), (see table 3.13). The significant negative correlation indicated, that the higher the baseline levels of depression were as measured by the (BDI), the lower the CD4-T lymphocyte counts were.

3.2.7 RELATIONSHIPS BETWEEN PSYCHOLOGICAL AND IMMUNOLOGICAL VARIABLES ON POST-EXPERIMENTAL MEASURES FOR ALL CASES.

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for all cases, a significant positive correlation was found between the CD4-T lymphocyte counts and total lymphocyte counts ($r = 0.6358$, $p < 0.05$), (see table 3.14). The significant positive correlation indicated, that the higher the post-test levels of total lymphocytes were, the higher the CD4-T lymphocyte counts were.

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for all cases, a significant negative correlation was found between the CD4:CD8-T lymphocyte ratio counts and CD8-T lymphocyte counts ($r = -0.5820$, $p < 0.01$), (see table 3.14). The significant negative correlation indicated, that the higher the post-test levels of CD8-T lymphocytes were, the lower the CD4: CD8-T lymphocyte ratio count was.

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for all cases, a significant positive correlation was found between POMS factor Tension-Anxiety and POMS factor Depression-Dejection ($r = 0.7659$, $p < 0.01$), (see table 3.14). The significant positive correlation indicated, that the higher the post-test levels of Tension-Anxiety were, the higher the Depression-Dejection values were .

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for all cases, a significant negative correlation was found between POMS factor Tension-Anxiety and POMS factor Vigor-Activity ($r = -0.4434$, $p < 0.05$), (see table 3.14). The significant negative correlation indicated, that the lower the post-test levels of Tension-Anxiety were, the higher the Vigor-Activity values were .

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for all cases, a significant positive correlation was found between POMS factor Tension-Anxiety and POMS factor Fatigue-Inertia ($r = 0.5768$, $p < 0.01$), (see table 3.14). The significant positive correlation indicated, that the higher the post-test levels of Tension-Anxiety were, the higher the Fatigue-Inertia values were .

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for all cases, a significant positive correlation was found between POMS factor Tension-Anxiety and the Beck Depression Inventory (BDI) ($r = 0.7511$, $p < 0.01$), (see table 3.14). The significant positive correlation indicated, that the higher the post-test levels of Tension-Anxiety were, the higher the depression values, as measured by the (BDI) were .

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for all cases, a significant positive correlation was found between the Beck Depression Inventory (BDI) and POMS factor Depression-Dejection ($r = 0.6917$, $p < 0.01$), (see table 3.14). The significant positive correlation indicated, that the higher the post-test levels of (BDI) were, the higher the Depression-Dejection values were .

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for all cases, a significant positive correlation was found between the Beck Depression Inventory (BDI) and POMS factor Fatigue-Inertia ($r = 0.4270$, $p < 0.05$), (see table 3.14). The significant positive correlation indicated, that the higher the post-test levels of (BDI) were, the higher the Fatigue-Inertia

Table 3.14 Intercorrelation matrix for psychological and immunological variables on post-test measures for all cases

	Lympho	CD4	CD8	Ratio	POMS T	D	V	F	B.D.I.
CD4	0.6358*	1.000	0.1934	0.3175	-0.2905	-0.3925	0.1322	-0.2007	-0.3042
CD8	0.7276	0.1934	1.0000	-0.5820	-0.1610	-0.1555	0.0613	-0.0370	-0.3351
Ratio	-0.0391	0.3175	-0.5820**	1.0000	0.1877	0.0204	0.0162	-0.0341	0.2491
POMS T	-0.1807	-0.2905	-0.1610	0.1877	1.0000	0.7659**	-0.4434*	0.5768**	0.7511**
D	-0.3483	-0.3925	-0.1555	0.0204	0.7659**	1.0000	-0.3497	0.6919	0.6917
V	0.2633	0.1322	0.0613	0.0162	-0.4434*	-0.3497	1.0000	-0.4808	-0.4506
F	-0.1736	-0.2007	-0.0370	-0.0341	0.5768**	0.6919**	-0.4808	1.0000	0.4270
BDI	-0.3817	-0.3042	0.3351	0.2491	0.7511**	0.6917**	-0.4506*	0.4270*	1.0000

p : 0.05*

p : 0.01*

p : 0.001***

Lympho = Post-intervention lymphocytes for all cases

CD4 T-cells = Post-intervention T-Helper / inducer cells for all cases

CD8 T-cells = Post-intervention T-Suppresser cells for all cases

CD4:CD8 ratio = Post-intervention Helper : Suppresser ratio for all cases

POMS T = Post-intervention factor Tension - Anxiety for all cases

POMS D = Post-intervention factor Depression -Dejection for all cases

POMS V = Post-intervention factor Vigor - Activity for all cases

POMS F = Post-intervention factor Fatigue-Inertia for all cases

B.D.INV = Post-intervention Beck Depression Inventory for all cases

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for all cases, a significant negative correlation was found between the Beck Depression Inventory (BDI) and POMS factor Vigor-Activity ($r = -0.4506$, $p < 0.01$), (see table 3.14). The significant negative correlation indicated, that the higher the post-test levels of (BDI) were, the lower the Vigor-Activity values were .

In an intercorrelation matrix for the psychological and immunological variables on post-test measures for all cases, a significant positive correlation was found between the POMS factor Fatigue-Inertia and POMS factor Depression-Dejection ($r = 0.6919$, $p < 0.01$), (see table 3.14). The significant positive correlation indicated, that the higher the post-test levels of Fatigue-Inertia were, the higher the Depression-Dejection levels were.

3.3 DESCRIPTIVE STATISTICAL ANALYSIS

INTRODUCTION

In order to assess the effect of the psychophysiological EMG biofeedback-assisted relaxation training intervention on experimental subjects, tables and graphs, representing the baseline, the 5 EMG-feedback sessions, as well as the 6-week follow-up session, were constructed for each subject in the experimental group. The baseline session was made up of two 5-minute EMG frontalis baseline readings. The average of these two 5-minute baseline measurements constituted the pre-intervention relaxation level. The EMG-feedback training sessions were made up of five 20-minute sessions, with readings been taken at 5-minute intervals. During the follow-up session, two 5-minute recordings were taken again on EMG frontalis to assess the ability of the subjects to relax without direct auditory feedback from the EMG equipment.

3.3.1. INDIVIDUAL RESULTS OBTAINED BY SUBJECTS IN THE EXPERIMENTAL GROUP DUE TO THE EFFECT OF THE ELECTROMYOGRAPHIC-FEEDBACK RELAXATION TRAINING.

The results obtained by each of the 14 subjects in the experimental or treatment group on psychophysiological tension levels during the Electromyographic-feedback sessions as well as the baseline and 6-week follow up session were recorded and tabulated.
These results will be discussed under this section. Histograms representing mean psychophysiological deviations from baseline recordings due to the effect of the Electromyographic-feedback sessions on the experimental subjects will also be discussed in the section that follows.

3.3.1.1 DESCRIPTIVE STATISTICAL ANALYSIS: THE EFFECT OF THE ELECTROMYOGRAPHIC-FEEDBACK SESSIONS ON EXPERIMENTAL SUBJECTS.

3.3.1.1.1 EXPERIMENTAL SUBJECT 1

Experimental subject 1, recorded a mean baseline psychophysiological EMG level of 2.9 mv\rms. Session 1 deviated from 3 mv\rms at the 5 minute recording, to 2.6 at the 20th minute recording. The mean EMG relaxation level for session 1 was 2.8 mv\rms.
Session 2 deviated from 2.9 mv\rms at the 5 minute recording, to 1.8 at the 20th minute recording. The mean EMG relaxation level for session 2 was 2.25 mv\rms.
Session 3 deviated from 2.6 mv\rms at the 5 minute recording, to 1.4 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.8 mv\rms.
Session 4 deviated from 2.1 mv\rms at the 5 minute recording, to 1.3 at the 20th minute recording. The mean EMG relaxation level for session 4 was 1.55 mv\rms.
Session 5 deviated from 1.6 mv\rms at the 5 minute recording, to 1.1 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.35 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.45 mv\rms, (see table 3.15.1). The mean EMG deviation from the baseline measures of experimental subject 1, changed from 2.9 mv\rms to 1.35 in session 5, and to 1.45 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback, (see figure 3.1).

Table 3.15.1: Electromyographic-feedback results obtained by Subject 1.

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
1.	5	2.8	3	2.9	2.6	2.1	1.6	1.6
	10	3	2.9	2.3	1.6	1.5	1.2	1.3
	15		2.7	2.0	1.6	1.3	1.5	
	20		2.6	1.8	1.4	1.3	1.1	
	mean x	2.9	2.8	2.25	1.8	1.55	1.35	1.45

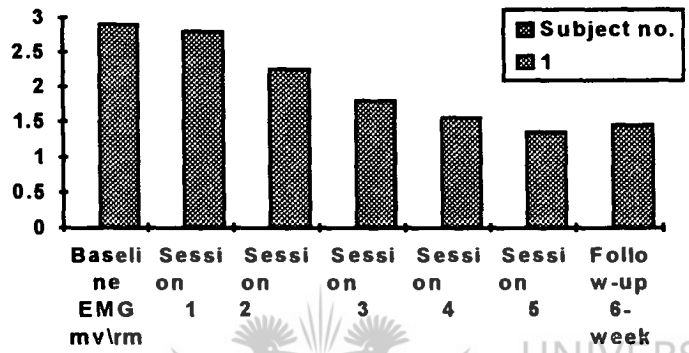

FIGURE 3.1 Histogram representing the mean psychophysiological deviation from baseline recordings, due to the effect of the Electromyographic-feedback sessions on experimental subject 1.

3.3.1.1.2 EXPERIMENTAL SUBJECT 2

Experimental subject 2, recorded a mean baseline psychophysiological EMG level of 3.5 mv\rms. Session 1 deviated from 4 mv\rms at the 5 minute recording, to 2.8 at the 20th minute recording. The mean EMG relaxation level for session 1 was 3.0 mv\rms. Session 2 deviated from 3.8 mv\rms at the 5 minute recording, to 4.1 at the 20th minute recording. The mean EMG relaxation level for session 2 was 3.9 mv\rms.

Session 3 deviated from 2.9 mv\rms at the 5 minute recording, to 1.8 at the 20th minute recording. The mean EMG relaxation level for session 3 was 3.0 mv\rms.

Session 4 deviated from 1.6 mv\rms at the 5 minute recording, to 2.6 at the 20th minute recording. The mean EMG relaxation level for session 4 was 2.6 mv\rms.
Session 5 deviated from 2.9 mv\rms at the 5 minute recording, to 2.4 at the 20th minute recording. The mean EMG relaxation level for session 5 was 2.15 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 3.95 mv\rms, (see table 3.15.2). The mean EMG deviation from the baseline measures of experimental subject 2, changed from 3.5 mv\rms to 2.15 in session 5, and to 3.95 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than session 5, but lower than the 6-week follow up session, the above deviation can be considered significant, in terms of the baseline-follow up relaxation effect of the EMG-feedback, (See figure 3.2)

Table 3.15.2: Electromyographic-feedback results obtained by Subject 2.

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
2.	5	4	4	3.8	2.9	1.6	2.9	4.5
	10	3.2	2.9	4	2.5	3	1.4	3.4
	15		3	3.6	3.8	3.2	1.9	
	20		2.8	4.1	1.8	2.6	2.4	
	mean x	3.5	3	3.9	3	2.6	2.15	3.95

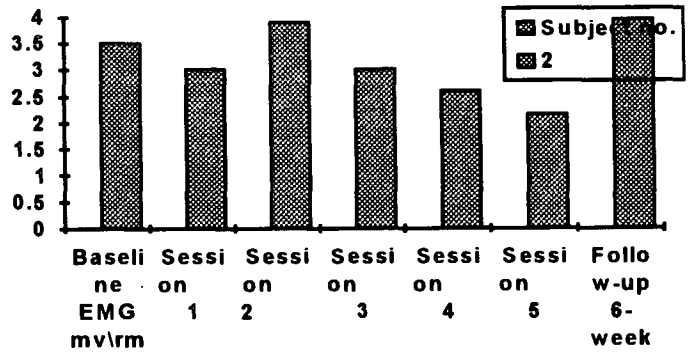

FIGURE 3.2 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 2.

3.3.1.1.3 EXPERIMENTAL SUBJECT 3

Experimental subject 3, recorded a mean baseline psychophysiological EMG level of 3.37 mv\rms. Session 1 deviated from 3.6 mv\rms at the 5 minute recording, to 2.4 at the 20th minute recording. The mean EMG relaxation level for session 1 was 2.9 mv\rms.
Session 2 deviated from 2.8 mv\rms at the 5 minute recording, to 1.8 at the 20th minute recording. The mean EMG relaxation level for session 2 was 2.15 mv\rms.
Session 3 deviated from 2.5 mv\rms at the 5 minute recording, to 1.0 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.7 mv\rms.
Session 4 deviated from 2.0 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 4 was 1.52 mv\rms.
Session 5 deviated from 1.9 mv\rms at the 5 minute recording, to 0.8 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.42 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.65 mv\rms, (see table 3.15.3). The mean EMG deviation from the baseline measures of experimental subject 3, changed from 3.37 mv\rms to 1.42 in session 5, and to 1.65 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback, (see figure 3.3).

Table 3.15.3 Electromyographic-feedback results obtained by Subject 3

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
3.	5	3.5	3.6	2.8	2.5	2	1.9	2
	10	3.25	2.5	2	1.9	1.4	1.6	1.3
	15		3.1	2	1.4	1.5	1.4	
	20		2.4	1.8	1	1.2	0.8	
	mean x	3.37	2.9	2.15	1.7	1.52	1.42	1.65

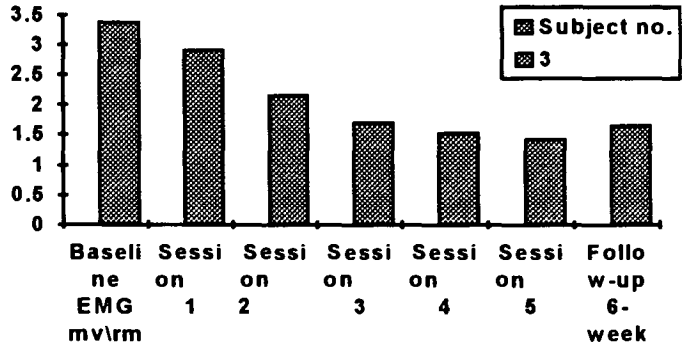

FIGURE 3.3 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 3.

3.3.1.1.4 EXPERIMENTAL SUBJECT 4

Experimental subject 4, recorded a mean baseline psychophysiological EMG level of 2.9 mv\rms. Session 1 deviated from 1.8 mv\rms at the 5 minute recording, to 2.1 at the 20th minute recording. The mean EMG relaxation level for session 1 was 2.25 mv\rms.
Session 2 deviated from 3.0 mv\rms at the 5 minute recording, to 1.9 at the 20th minute recording. The mean EMG relaxation level for session 2 was 2.32 mv\rms.
Session 3 deviated from 2.0 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.85 mv\rms.
Session 4 deviated from 0.7 mv\rms at the 5 minute recording, to 0.6 at the 20th minute recording. The mean EMG relaxation level for session 4 was 0.95 mv\rms.
Session 5 deviated from 1.8 mv\rms at the 5 minute recording, to 0.9 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.17 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.40 mv\rms, (see table 3.15.4). The mean EMG deviation from the baseline measures of experimental subject 4, changed from 2.9 mv\rms to 1.17 in session 5, and to 1.40 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback, (see figure 3.4).

Table 3.15.4: Electromyographic-feedback results obtained by Subject 4

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
4	5	3	1.8	3	2	0.7	1.8	1.7
	10	2.8	2.9	2.8	1.6	0.9	1.1	1.1
	15		2.2	1.6	1.4	1.6	0.9	
	20		2.1	1.9	1.2	0.6	0.9	
	mean x	2.9	2.25	2.32	1.85	0.95	1.17	1.4

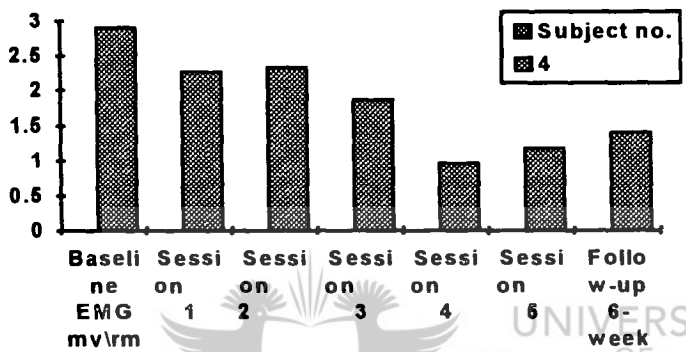

FIGURE 3.4 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 4.

3.3.1.1.5 EXPERIMENTAL SUBJECT 5

Experimental subject 5, recorded a mean baseline psychophysiological EMG level of 2.65 mv\rms. Session 1 deviated from 2.0 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 1 was 1.57 mv\rms.
Session 2 deviated from 1.9 mv\rms at the 5 minute recording, to 0.7 at the 20th minute recording. The mean EMG relaxation level for session 2 was 1.57 mv\rms.
Session 3 deviated from 1.8 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.55 mv\rms.

Session 4 deviated from 1.7 mv\rms at the 5 minute recording, to 0.9 at the 20th minute recording. The mean EMG relaxation level for session 4 was 1.0 mv\rms.
Session 5 deviated from 2.4 mv\rms at the 5 minute recording, to 0.9 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.6 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.75 mv\rms, (see table 3.15.5). The mean EMG deviation from the baseline measures of experimental subject 5, changed from 2.65 mv\rms to 1.6 in session 5, and to 1.75 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback, (see figure 3.5).

Table 3.15.5 Electromyographic-feedback results obtained by Subject 5

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
5	5	2.5	2	1.9	1.8	1.7	2.4	1.7
	10	2.8	1.5	2.9	1.8	0.3	1.7	1.8
	15		1.6	0.8	1.4	1.1	1.4	
	20		1.2	0.7	1.2	0.9	0.9	
	mean x	2.65	1.57	1.57	1.55	1	1.6	1.75

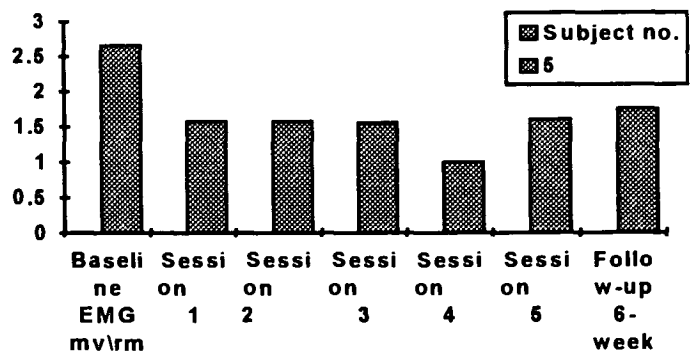

FIGURE 3.5 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 5.

3.3.1.1.6 EXPERIMENTAL SUBJECT 6

Experimental subject 6, recorded a mean baseline psychophysiological EMG level of 2.4 mv\rms. Session 1 deviated from 2 mv\rms at the 5 minute recording, to 1.5 at the 20th minute recording. The mean EMG relaxation level for session 1 was 1.72 mv\rms.
Session 2 deviated from 2.1 mv\rms at the 5 minute recording, to 0.9 at the 20th minute recording. The mean EMG relaxation level for session 2 was 1.42 mv\rms.
Session 3 deviated from 1.5 mv\rms at the 5 minute recording, to 1.1 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.07 mv\rms.
Session 4 deviated from 2.0 mv\rms at the 5 minute recording, to 0.3 at the 20th minute recording. The mean EMG relaxation level for session 4 was 1.05 mv\rms.
Session 5 deviated from 1.8 mv\rms at the 5 minute recording, to 1.5 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.47 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.55 mv\rms, (see table 3.15.6). The mean EMG deviation from the baseline measures of experimental subject 6, changed from 2.4 mv\rms to 1.47 in session 5, and to 1.55 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback, (see figure 3.6).

Table 3.15.6 Electromyographic-feedback results obtained by Subject 6

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
6	5	2	2	2.1	1.5	2	1.8	1.8
	10	2.8	2	1.3	1.4	1	1.2	1.3
	15		1.4	1.4	0.3	0.9	1.4	
	20		1.5	0.9	1.1	0.3	1.5	
	mean x	2.4	1.72	1.42	1.07	1.05	1.47	1.55

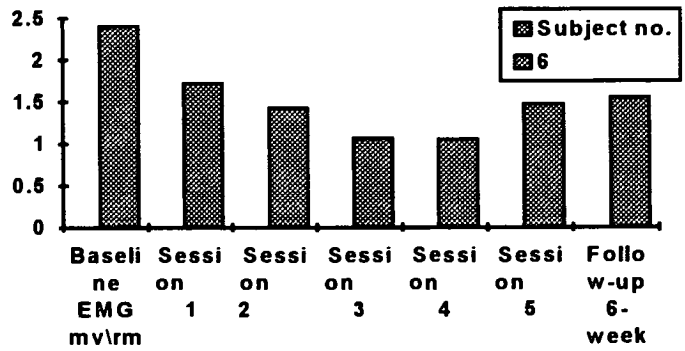

FIGURE 3.6 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 6.

3.3.1.1.7 EXPERIMENTAL SUBJECT 7

Experimental subject 7, recorded a mean baseline psychophysiological EMG level of 1.95 mv\rms. Session 1 deviated from 2.9 mv\rms at the 5 minute recording, to 1.4 at the 20th minute recording. The mean EMG relaxation level for session 1 was 1.82 mv\rms.
Session 2 deviated from 0.9 mv\rms at the 5 minute recording, to 0.7 at the 20th minute recording. The mean EMG relaxation level for session 2 was 0.9 mv\rms.
Session 3 deviated from 1.4 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.25 mv\rms.
Session 4 deviated from 1.8 mv\rms at the 5 minute recording, to 0.7 at the 20th minute recording. The mean EMG relaxation level for session 4 was 1.02 mv\rms.
Session 5 deviated from 0.9 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.0 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.4 mv\rms, (see table 3.15.7). The mean EMG deviation from the baseline measures of experimental subject 7, changed from 1.95 mv\rms to 1.0 in session 5, and to 1.4 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback, (see figure 3.7).

Table 3.15.7 Electromyographic-feedback results obtained by Subject 7

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
7	5	2	2.9	0.9	1.4	1.8	0.9	1.3
	10	1.9	1.7	0.9	1.2	1.1	1.2	1.5
	15		1.3	1.1	1.2	0.5	0.7	
	20		1.4	0.7	1.2	0.7	1.2	
	mean x	1.95	1.82	0.9	1.25	1.02	1.0	1.4

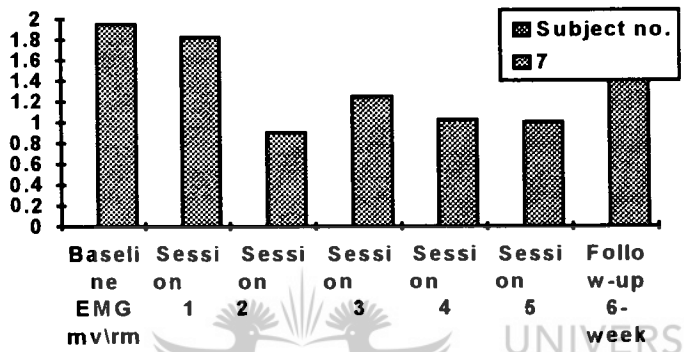

FIGURE 3.7 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 7.

3.3.1.1.8 EXPERIMENTAL SUBJECT 8

Experimental subject 8, recorded a mean baseline psychophysiological EMG level of 4.5 mv\rms. Session 1 deviated from 4.9 mv\rms at the 5 minute recording, to 3.9 at the 20th minute recording. The mean EMG relaxation level for session 1 was 4.3 mv\rms.
Session 2 deviated from 5.0 mv\rms at the 5 minute recording, to 4.2 at the 20th minute recording. The mean EMG relaxation level for session 2 was 4.35 mv\rms.
Session 3 deviated from 4.0 mv\rms at the 5 minute recording, to 3.1 at the 20th minute recording. The mean EMG relaxation level for session 3 was 3.15 mv\rms.

Session 4 deviated from 3.2 mv\rms at the 5 minute recording, to 2.5 at the 20th minute recording. The mean EMG relaxation level for session 4 was 3.07 mv\rms.
Session 5 deviated from 2.8 mv\rms at the 5 minute recording, to 1.9 at the 20th minute recording. The mean EMG relaxation level for session 5 was 2.25 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 4.95 mv\rms, (see table 3.15.8). The mean EMG deviation from the baseline measures of experimental subject 8, changed from 4.5 mv\rms to 2.25 in session 5, and to 4.95 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than session 5, but lower than the 6-week follow up session, the above deviation can be considered significant, in terms of the baseline-follow up relaxation effect of the EMG-feedback, (See figure 3.8)

Table 3.15.8 Electromyographic-feedback results obtained by Subject 8

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
8	5	4.8	4.9	5	4	3.2	2.8	5.2
	10	4.2	4.2	4.1	3	3.3	1.7	4.7
	15		4.2	4.1	2.5	3.3	2.5	
	20		3.9	4.2	3.1	2.5	1.9	
	mean x	4.5	4.3	4.35	3.15	3.07	2.25	4.95

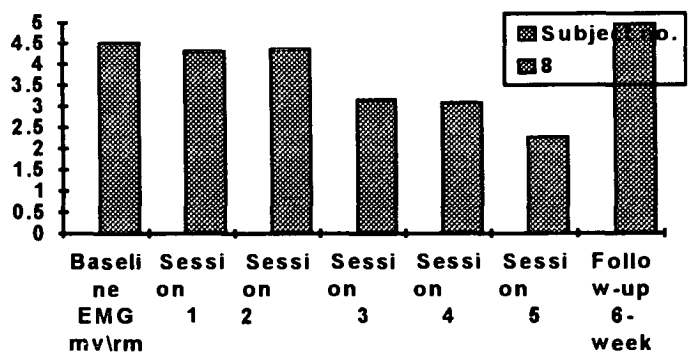

FIGURE 3.8 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 8.

3.3.1.1.9 EXPERIMENTAL SUBJECT 9

Experimental subject 9. recorded a mean baseline psychophysiological EMG level of 1.9 mv\rms. Session 1 deviated from 1.9 mv\rms at the 5 minute recording, to 1.0 at the 20th minute recording. The mean EMG relaxation level for session 1 was 1.4 mv\rms.
Session 2 deviated from 2.0 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 2 was 1.42 mv\rms.
Session 3 deviated from 1.5 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.32 mv\rms.
Session 4 deviated from 1.2 mv\rms at the 5 minute recording, to 1.0 at the 20th minute recording. The mean EMG relaxation level for session 4 was 1.15 mv\rms.
Session 5 deviated from 1.6 mv\rms at the 5 minute recording, to 1.1 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.07 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.55 mv\rms, (see table 3.15.9). The mean EMG deviation from the baseline measures of experimental subject 9, changed from 1.9 mv\rms to 1.07 in session 5, and to 1.55 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback, (see figure 3.9).

Table 3.15.9 Electromyographic-feedback results obtained by Subject 9

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
9	5	2.1	1.9	2	1.5	1.2	1.6	1.8
	10	1.7	1.6	1.6	1.4	1.3	0.9	1.3
	15		1.1	0.9	1.2	1.1	0.7	
	20		1.0	1.2	1.2	1.0	1.1	
	mean x	1.9	1.4	1.42	1.32	1.15	1.07	1.55

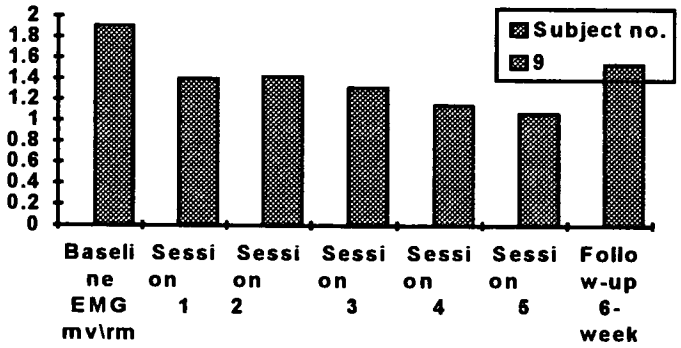

FIGURE 3.9 Histogram representing the mean psychophysiological deviation from baseline recordings, due to the effect of the Electromyographic-feedback sessions on experimental subject 9.

3.3.1.1.10 EXPERIMENTAL SUBJECT 10

Experimental subject 10, recorded a mean baseline psychophysiological EMG level of 2.4 mv\rms. Session 1 deviated from 3.0 mv\rms at the 5 minute recording, to 2.5 at the 20th minute recording. The mean EMG relaxation level for session 1 was 2.42 mv\rms.
Session 2 deviated from 2.9 mv\rms at the 5 minute recording, to 1.3 at the 20th minute recording. The mean EMG relaxation level for session 2 was 2.2 mv\rms.
Session 3 deviated from 1.8 mv\rms at the 5 minute recording, to 0.3 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.37 mv\rms.
Session 4 deviated from 2.1 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 4 was 1.7 mv\rms.
Session 5 deviated from 1.3 mv\rms at the 5 minute recording, to 1.3 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.32 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.70 mv\rms, (see table 3.15.10). The mean EMG deviation from the baseline measures of experimental subject 10, changed from 2.4 mv\rms to 1.32 in session 5, and to 1.70 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback, (see figure 3.10).

Table 3.15.10 Electromyographic-feedback results obtained by Subject 10

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
10	5	2	3	2.9	1.8	2.1	1.3	2.1
	10	2.8	2.4	3.1	1.9	2.3	1.3	1.3
	15		1.8	1.5	1.5	1.2	1.4	
	20		2.5	1.3	0.3	1.2	1.3	
	mean x	2.4	2.42	2.2	1.37	1.7	1.32	1.7

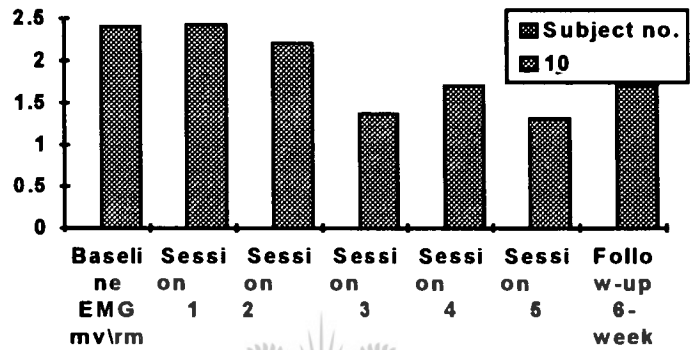

FIGURE 3.10 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 10.

3.3.1.1.11 EXPERIMENTAL SUBJECT 11

Experimental subject 11, recorded a mean baseline psychophysiological EMG level of 1.85 mv\rms. Session 1 deviated from 2.4 mv\rms at the 5 minute recording, to 1.6 at the 20th minute recording. The mean EMG relaxation level for session 1 was 2.02 mv\rms.
Session 2 deviated from 1.0 mv\rms at the 5 minute recording, to 0.8 at the 20th minute recording. The mean EMG relaxation level for session 2 was 1.02 mv\rms.
Session 3 deviated from 1.6 mv\rms at the 5 minute recording, to 1.3 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.55 mv\rms.

Session 4 deviated from 0.9 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 4 was 1.0 mv\rms.
Session 5 deviated from 1.3 mv\rms at the 5 minute recording, to 1.4 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.32 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.45 mv\rms, (see table 3.15.11). The mean EMG deviation from the baseline measures of experimental subject 11, changed from 1.85 mv\rms to 1.32 in session 5, and to 1.45 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback, (see figure 3.11).

Table 3.15.11 Electromyographic-feedback results obtained by Subject 11

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
11	5	1.8	2.4	1.0	1.6	0.9	1.3	1.6
	10	1.9	1.6	0.9	1.8	0.7	1.2	1.3
	15		2.5	1.4	1.5	1.2	1.4	
	20		1.6	0.8	1.3	1.2	1.4	
	mean x	1.85	2.02	1.02	1.55	1	1.32	1.45

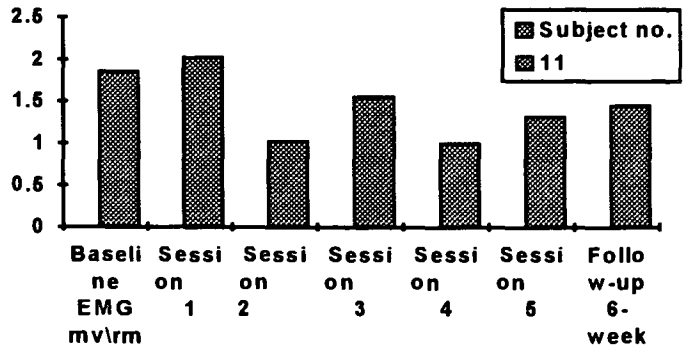

FIGURE 3.11 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 11.

3.3.1.1.12 EXPERIMENTAL SUBJECT 12

Experimental subject 12, recorded a mean baseline psychophysiological EMG level of 1.6 mv\rms. Session 1 deviated from 1.6 mv\rms at the 5 minute recording, to 1.1 at the 20th minute recording. The mean EMG relaxation level for session 1 was 1.47 mv\rms.
Session 2 deviated from 1.1 mv\rms at the 5 minute recording, to 0.9 at the 20th minute recording. The mean EMG relaxation level for session 2 was 1.0 mv\rms.
Session 3 deviated from 0.7 mv\rms at the 5 minute recording, to 0.9 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.0 mv\rms.
Session 4 deviated from 1.4 mv\rms at the 5 minute recording, to 1.3 at the 20th minute recording. The mean EMG relaxation level for session 4 was 1.37 mv\rms.
Session 5 deviated from 1.1 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.22 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.3 mv\rms, (see table 3.15.12). The mean EMG deviation from the baseline measures of experimental subject 12, changed from 1.6 mv\rms to 1.22 in session 5, and to 1.30 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback, (see figure 3.12).

Table 3.15.12 Electromyographic-feedback results obtained by Subject 12

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
12	5	1.5	1.6	1.1	0.7	1.4	1.1	1.5
	10	1.7	1.6	1.0	1.2	1.4	1.7	1.1
	15		1.6	1.0	1.2	1.4	0.9	
	20		1.1	0.9	0.9	1.3	1.2	
	mean x	1.6	1.47	1	1	1.37	1.22	1.3

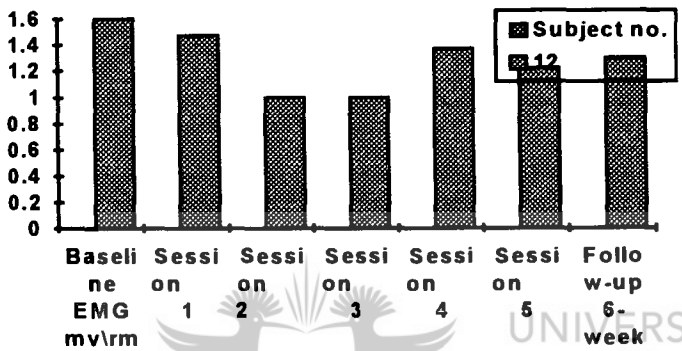

FIGURE 3.12 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 12.

3.3.1.1.13 EXPERIMENTAL SUBJECT 13

Experimental subject 13, recorded a mean baseline psychophysiological EMG level of 2.0 mv\rms. Session 1 deviated from 1.7 mv\rms at the 5 minute recording, to 1.0 at the 20th minute recording. The mean EMG relaxation level for session 1 was 1.47 mv\rms.
Session 2 deviated from 1.8 mv\rms at the 5 minute recording, to 0.7 at the 20th minute recording. The mean EMG relaxation level for session 2 was 1.10 mv\rms.
Session 3 deviated from 1.4mv\rms at the 5 minute recording, to 1.4 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.45 mv\rms.

Session 4 deviated from 1.5 mv\rms at the 5 minute recording, to 1.5 at the 20th minute recording. The mean EMG relaxation level for session 4 was 1.67 mv\rms.
Session 5 deviated from 1.9 mv\rms at the 5 minute recording, to 1.1 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.40 mv\rms.
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.45 mv\rms. (see table 3.15.13). The mean EMG deviation from the baseline measures of experimental subject 13, changed from 2.0 mv\rms to 1.40 in session 5, and to 1.45 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback. (see figure 3.13).

Table 3.15.13 Electromyographic-feedback results obtained by Subject 13

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
13	5	2	1.7	1.8	1.4	1.5	1.9	1.7
	10	2	2	1.0	1.5	1.6	1.2	1.2
	15		1.2	0.9	1.5	2.1	1.4	
	20		1.0	0.7	1.4	1.5	1.1	
	mean x	2	1.47	1.1	1.45	1.67	1.4	1.45

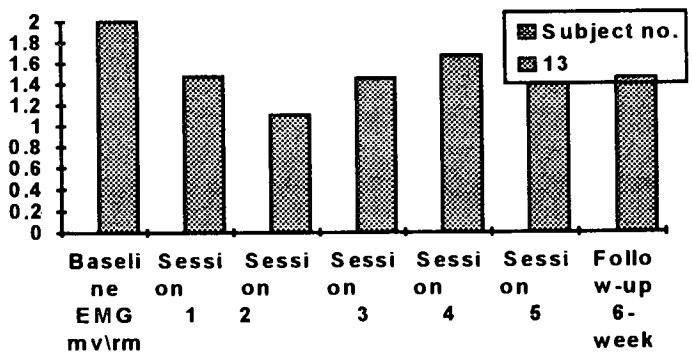

FIGURE 3.13 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 13.

3.3.1.1.14 EXPERIMENTAL SUBJECT 14

Experimental subject 14, recorded a mean baseline psychophysiological EMG level of 2.3 mv\rms. Session 1 deviated from 2.6 mv\rms at the 5 minute recording, to 1.4 at the 20th minute recording. The mean EMG relaxation level for session 1 was 1.75 mv\rms.
Session 2 deviated from 2.1 mv\rms at the 5 minute recording, to 1.2 at the 20th minute recording. The mean EMG relaxation level for session 2 was 1.35 mv\rms.
Session 3 deviated from 1.5 mv\rms at the 5 minute recording, to 1.4 at the 20th minute recording. The mean EMG relaxation level for session 3 was 1.27 mv\rms.
Session 4 deviated from 1.2 mv\rms at the 5 minute recording, to 0.9 at the 20th minute recording. The mean EMG relaxation level for session 4 was 1.2 mv\rms.
Session 5 deviated from 1.5 mv\rms at the 5 minute recording, to 1.4 at the 20th minute recording. The mean EMG relaxation level for session 5 was 1.4 mv\rms,
The mean 6-week follow up psychophysiological EMG level was recorded as being 1.55 mv\rms, (see table 3.15.14). The mean EMG deviation from the baseline measures of experimental subject 14, changed from 2.3 mv\rms to 1.4 in session 5, and to 1.55 in the 6-week follow up session. As the mean baseline relaxation levels were recorded as being higher, than either session 5 or the 6-week follow up session, the above deviation can be considered significant, in terms of the relaxation effect of the EMG-feedback, (see figure 3.14).

Table 3.15.14. Electromyographic-feedback results obtained by Subject 14

		Baseline EMG mv\rms	Session 1	Session 2	Session 3	Session 4	Session 5	Follow-up 6-week EMG mv\rms
Subject no.	Minutes							
14	5	2.1	2.6	2.1	1.5	1.2	1.5	1.8
	10	2.5	1.8	0.9	1.4	1.4	1.4	1.3
	15		1.2	1.2	1.4	1.3	1.3	
	20		1.4	1.2	1.4	0.9	1.4	
	mean x	2.3	1.75	1.35	1.27	1.2	1.4	1.55

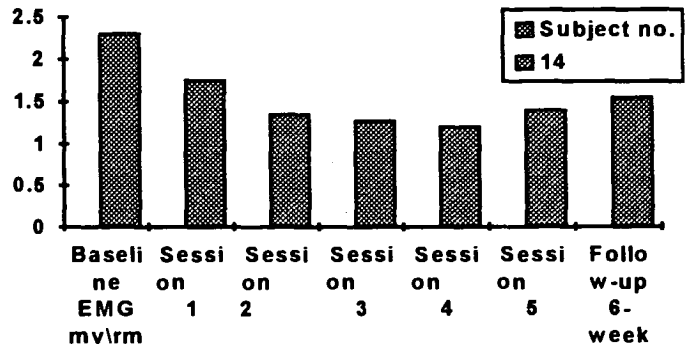

FIGURE 3.14 Histogram representing the mean psychophysiological deviation from baseline recordings due to the effect of the Electromyographic-feedback sessions on experimental subject 14.

In the following chapter, the results recorded and statistically analyzed in this chapter, will be discussed and conclusions in terms of the hypotheses will be reached.

CHAPTER FOUR
DISCUSSION AND CONCLUSIONS.

4.1 INTRODUCTION

The need for responsive health care targeted to the specific problems of persons infected with the human immunodeficiency virus (HIV), is urgent and rapidly growing. Infection with HIV is characterized by a progressive course of immunosuppression and increased symptom severity over a period of 10-15 years, which culminates in Acquired Immune deficiency syndrome (AIDS) and eventually death (Collier, Bozzette & Coobs, 1990).

It has also become well-known that the need for treatment and management of HIV-seropositive patients in South-Africa, will outstrip the presently available health resources to such an extent, that it could destroy the social infrastructure of South-Africa (Epidemiological comments, June 1995). Herein, it would appear that the present available biomedical treatments would not be sufficient to stem this tide. Adding to the above problem the high cost of the available antiviral medications, as well as the hematological side-effects associated with long term use of these antiviral drugs, makes them less efficient for use. Adjunctive behavioral treatment methods to the presently available biomedical treatments have therefore become a necessity in treating HIV-seropositve patients.

Previous research conducted by Antoni et al., (1990) and Schneiderman (1992) indicated that biopsychosocial treatment interventions utilizing aerobic exercise and cognitive-behavioral therapy specifically designed to enhance immune competence at early stages of HIV infection may provide a means of increasing resistance to opportunistic infections.

Similar research conducted by Wolff et al., (1996) revealed support for the Antoni et al., (1990) and Schneiderman (1992) studies, as clinical improvements were observed in cell-mediated immune lymphocyte subsets namely, CD4-T lymphocyte counts and CD4:CD8 T lymphocyte ratio counts, as well as enhancements in the mood states of asymptomatic and early symptomatic HIV-seropositive patients.
The above pilot intervention completed by Wolff et al., (1996) had however, not directly addressed specific physiological variables associated with HIV infection. Adding Electromyographic-feedback relaxation training to the above therapeutic modalities, increased the likelihood of addressing specific physiological variables associated with HIV-seropositivity, and served as a direct operant intervention in indirectly enhancing immune system functioning through psychophysiological mechanisms, or by means of the relaxation effect which EMG-feedback relaxation training produced.

The purpose then of this study, was to reinforce the positive psychological and immunologic trends of previous HIV \ AIDS studies conducted at the Clinic and Center for Behavioral Medicine, and to address specific physiological variables of HIV seropositivity, by including EMG -feedback relaxation training in this study, and combining it with cognitive-behavioral therapy and aerobic exercise offered on an individual basis over an 8 week period. By replacing the group-based cognitive-behavioral intervention of the pilot study, with individualised cognitive-behavioral therapy and EMG-feedback training, the emphasis of this intervention was not so much on anger-expression as was the aim of the group sessions, but rather on physiological tension-reduction in order to alleviate anxiety. Furthermore, an attempt was made to produce significant positive changes in those psychological states more specifically related to psychophysiological and or physical functioning. These included vigor-activity and fatigue-inertia levels, important in the overall health status of HIV-seropositve patients.

The specific Research Hypotheses for this study were:

(1) There would be greater increases in the total lymphocyte and CD4 T-cell mediated immune counts, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and Electromyographic (EMG)-feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

(2) There would be greater clinical improvements in the CD4:CD8 T-lymphocyte cell ratio, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

3a) There would be greater decreases in depression levels, as measured by the Beck Depression Inventory (B D I) and the Profile of Mood States (POMS) factor D, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

3b) There would be greater decreases in tension-anxiety levels, as measured by the POMS factor T, and decreases in EMG -physiological tension levels, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

3c) There would be greater decreases in fatigue-inertia levels, as measured by the POMS factor F, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

(4) There would be greater increases in Vigor-activity levels, as measured by the POMS factor V, in asymptomatic and early symptomatic HIV-seropositive experimental subjects exposed to a combined 8-week individualised cognitive-behavioral, ergometric aerobic exercise and EMG -feedback intervention, then in subjects of the control group, who only received an attention placebo procedure.

In order to perform this study, 26 subjects, from a larger Hillbrow Hospital AIDS out-patient population of (N=98), who fitted the inclusion criteria for participation in the study, were selected and randomly divided into an experimental group, (n=14) and delayed treatment control group, (n=12). More specifically, subjects were either asymptomatic or early symptomatic HIV-seropositives with baseline recordings of CD4-T lymphocytes of above 200, (CDC stages 2-3 and WR stages 2-4A, see inclusion criteria in chapter 2 under section 2.2.3).

The experimental group was subjected to a combined 8-week individualised biopsychosocial treatment intervention, composed of cognitive-behavioral therapy, electromyographic-feedback assisted relaxation training and ergometric aerobic activity. The delayed treatment control group was subjected to an 8-week placebo attention procedure with an emphasis on information provision regarding the psychological and medical implications of the AIDS disease. The subjects in this group were given equal amounts of time, but in group format. At the termination of the experimental intervention offered to the experimental group, the waiting list control group was then subjected to the intervention utilized in the experimental group, but in group format.

A pre to post-test analysis was done for the statistical data obtained from the above intervention for both the experimental and control groups. Psychological measures included, the Profile of Mood States (POMS), and the Beck Depression Inventory (B D I). This analysis also included baseline measures as well as post-test measures of immunological indices as obtained from blood-assay analysis of lymphocyte subsets. More specifically, immunological indices included CD4-T lymphocytes, CD8-T lymphocytes and CD4:CD8 T lymphocyte ratios. In addition to the above psychological and immunological analysis, a psychophysiological analysis of the Electromyographic-feedback sessions, including a baseline and a post-follow up assessment was done.
The findings obtained from the above analysis will be discussed in this chapter.
At first, the results regarding the pre-treatment equivalence between-groups will be discussed. This will be followed by a discussion on the effect of the individualised cognitive-behavioral intervention combined with ergometric aerobic exercise and EMG-feedback assisted relaxation training on immunological measures, following the effects of the same program on psychological and psychophysiological states in subjects of the experimental group. The effect of the attention placebo procedure on subjects of the control group as regards psychological and immunological variables will then follow. Finally, the interaction between changes in psychological and psychophysiological states, immunological functioning and HIV-seropositive status will be addressed.

4.2 PRETREATMENT EQUIVALENCE BETWEEN SUBJECTS OF THE EXPERIMENTAL AND CONTROL GROUPS

In order to assess the pretreatment or baseline equivalence between subjects of the experimental and control group, t-tests were conducted on these measures.
Findings supported pretreatment equivalence between the groups on all psychological measures namely, the Profile of Mood States (POMS), factors Tension-Anxiety, Depression-Dejection, Vigor-Activity and Fatigue-Inertia, and Depression using the Beck Depression Inventory. Findings also supported pretreatment equivalence between the groups on all immunological measures namely, total lymphocytes, CD4, CD8 and CD4:CD8-T lymphocyte ratios.

Results further supported pretreatment equivalence of the groups on gender distribution, socioeconomic status, age distribution and nationality (all South-Africans).
The distribution of stage of HIV-infection in the experimental group was skewed, by the presence of two subjects with CD4-T lymphocyte counts of below 200.
However, similarity of groups with regard to stage of HIV-infection was supported by statistical analysis.

4.3 THE EFFECT OF THE EXPERIMENTAL INTERVENTION ON SELECTED INDICES OF IMMUNOLOGICAL FUNCTIONING

4.3.1 THE EFFECT OF THE EXPERIMENTAL INTERVENTION ON SELECTED INDICES OF IMMUNOLOGICAL FUNCTIONING FOR SUBJECTS IN THE EXPERIMENTAL GROUP

Statistical tests done to determine the effects of the experimental intervention, which consisted of individualised cognitive-behavioral therapy combined with ergometric aerobic exercise and Electromyographic-feedback, revealed no statistically significant between-group differences in terms of immunological measures.
Although there were no statistically significant between-group differences, there were some pre to post test statistically significant differences in the immunological indices of the experimental group, namely that the total amount of lymphocytes increased.
This increase in the total number of lymphocytes was also clinically significant, as there is a direct link between increases in the total number of lymphocytes and increased resistance to opportunistic infections associated with HIV infection.

There was also an overall increase in the helper CD4-T lymphocyte count of experimental subjects, which was also clinically but not statistically significant.
The increase in CD4-T lymphocyte counts can be considered clinically significant, as these cells confer their immunological effects by producing and releasing lymphokines that act as immunohormones, regulating other T-cell lines and macrophages.

Furthermore, they are the cells that are directly effected by the Human immunodeficiency virus (HIV), and the profound immune suppression that characterizes later stages of HIV infection is due to the progressive functional impairment and selective loss of CD4-T lymphocytes. The CD4-T lymphocyte count further serves as an indicator of disease progression and correlates highly with symptom severity. A decrease in these cells to a level of below 200 per volume of blood is associated with an increase in opportunistic infections and clinical AIDS.

In addition to the increases in CD4-T lymphocytes, there were also decreases in the overall counts of CD8-T lymphocytes, changing the CD4:CD8-T lymphocyte ratio in a direction that indicates an improvement in the immunological functioning relative to the deleterious effects of the HIV. The CD4:CD8-T lymphocyte ratio is related to severity of symptoms, including fatigue and depression, and is another marker for HIV related disease progression.

As the above findings were not statistically significant, but clinically significant, except in the case of total lymphocyte counts, the results can not be discussed in any degree, which would lead to the generalization of the data. Certain explanations can be given justifying the reasons for these findings being clinically rather than statistically significant. The Antoni et al., (1990) study as well as the Reed et al., (1994), the Eller (1995) and the Kiecolt-Glaser & Glaser (1992) studies, would indicate that the time lapse between initial and subsequent collections of immunological data was too short to detect any statistically significant differences. It is indeed possible, that statistically significant changes would have taken place if the intervention would have been conducted over a longer period of time, allowing for more changes to occur. It is also possible, that the measures used in this study for immunological analysis, were not sensitive enough to be discriminable in pre to post-test conditions, or allow for the detection of statistically significant between-group changes, as would be the utilisation of finer measures, such as those obtained by Antoni et al., (1990) & LaPerriere et al., (1990) as for example CD 56-T cells or a subset of CD4-T lymphocytes namely, (2H4+ T4+) cells.

In this regard, lack of statistically significant changes could be attributed to measures of immunocompetence rather than lack of significant changes as such. It is therefore possible, that the positive clinically significant changes could have resulted in statistically significant differences if the above issues had been considered.

4.3.2 THE EFFECT OF THE ATTENTION PLACEBO PROCEDURE ON SELECTED INDICES OF IMMUNOLOGICAL FUNCTIONING FOR SUBJECTS IN THE CONTROL GROUP

Statistical tests done to determine the effects of the 8-week placebo attention procedure with an emphasis on information provision regarding the psychological and medical implications of the AIDS disease, on subjects of the control group, revealed no statistically significant between-group differences in terms of immunological measures.
The statistical analysis also revealed that there were no pre to post test statistically significant differences in the immunological indices for subjects in the control group. This finding is in keeping with the specific hypotheses of the study, as no significant changes were expected to take place in any of the immunological variables for subjects in the delayed treatment control group. If changes would have taken place, they were expected to do so at a lesser degree than for subjects of the experimental group.

4.4 THE EFFECT OF THE EXPERIMENTAL INTERVENTION ON SELECTED INDICES OF PSYCHOLOGICAL FUNCTIONING

4.4.1 THE EFFECT OF THE EXPERIMENTAL INTERVENTION ON SELECTED INDICES OF PSYCHOLOGICAL FUNCTIONING FOR SUBJECTS IN THE EXPERIMENTAL GROUP

Statistical tests done to determine the effects of the experimental intervention which consisted of individualised cognitive-behavioral therapy combined with ergometric aerobic exercise and Electromyographic-feedback assisted relaxation training revealed several statistically significant between-group differences in terms of psychological measures.

More specifically, significant between-group differences were found on post-test levels of POMS factor Tension-Anxiety, Depression-Dejection, Fatigue-Inertia, Vigor-Activity, and depression as measured by the Beck Depression Inventory. As there were no significant differences in any of the above variables at pretreatment assessments between the groups, it is concluded that the significantly lower post-test levels of depression, tension-anxiety and fatigue-inertia, as well as the higher post-test levels of vigor-activity in subjects of the experimental or treatment group, were due to the effect of the experimental intervention. In addition to the statistically significant between-group changes on the above mentioned psychological measures, there were also some pre to post test statistically significant differences in the psychological indices of the experimental group. More specifically, statistically significant differences were recorded between baseline and post-test assessments on levels of tension-anxiety, depression-dejection, vigor-activity, and fatigue-inertia. The above findings are in keeping with the LaPerriere et al., (1990) study, as well as the Kiecolt-Glaser & Glaser (1992) overview, where it was indicated that stress management training would lead to improvements in general mood states and a decrease in overall mood disturbances in HIV-seropositive patients. The importance of the above findings, is that the more specific psychopathology-related changes in affective mood states namely, tension-anxiety and depression-dejection took place. Of further note, is that positive changes also took place on those psychological states more specifically related to psychophysiological functioning namely, vigor-activity and fatigue-inertia levels important in the overall health status of HIV-seropositives.

Placing the above finding into perspective, it would appear that the combined cognitive-behavioral, ergometric aerobic exercise and EMG-feedback intervention, led to increases in the vigor and overall energy levels of the experimental subjects, bringing about a more active approach to the management of HIV-seropositivity. There was also a significant decline in the fatigue levels of experimental subjects, decreasing the drop out rate of participants, especially during the later stages of the intervention, and increasing their motivation to participate actively in the aerobic exercise component of the intervention.

On the whole, the above findings would indicate that behavioral medicine interventions with an emphasis on biopsychosocial interactions would have psychophysiology specific effects, over and above the more common purely psychological effects of such interventions.

4.4.2 THE EFFECT OF THE PLACEBO ATTENTION PROCEDURE ON SELECTED INDICES OF PSYCHOLOGICAL FUNCTIONING FOR SUBJECTS IN THE CONTROL GROUP

Statistical tests done to determine the effects of the 8-week placebo attention procedure with an emphasis on information provision regarding the psychological and medical implications of the AIDS disease, on subjects of the delayed treatment control group revealed a statistically significant within-group difference in terms of psychological measures. The statistical analysis revealed that there was a pre to post-test statistically significant difference in the vigor-activity level for subjects in the control group. This finding however, also revealed that the statistically significant difference was of a lesser degree than that experienced by subjects of the experimental group. This finding is in keeping with the specific hypotheses of the study, as any significant changes that were expected to take place in any of the psychological variables for the control group, were expected to do so to a lesser extent than the experimental group. An important aspect of this finding, is that subjects in the control group were able to increase their vigor-activity levels, after only being informed of the importance of aerobic exercise and other active approaches in dealing with their infection, and not actually motivated to participate.
It was also inspirational to see, that a purely informational intervention done primarily as an attention placebo procedure could produce significant changes in the vigor-activity levels of these subjects. Unfortunately however, this significant change was limited to only the vigor-activity levels and did not take place for any other psychological variable in this group.

4.5 THE EFFECTS OF EMG -BIOFEEDBACK ASSISTED RELAXATION TRAINING ON PSYCHOIMMUNOLOGICAL STATES FOR SUBJECTS IN THE EXPERIMENTAL GROUP

INTRODUCTION

The pilot investigation for this study completed by Wolff et al., (1996) had not directly addressed specific physiological variables associated with HIV infection, nor had the pilot study determined whether subjects would relax better with the help of EMG-feedback assisted relaxation training, than without it. More specifically, the pilot study was composed of a group-based cognitive-behavioral intervention combined with aerobic exercise. Adding Electromyographic feedback to the above therapeutic modalities, increased the likelihood of addressing specific physiological variables associated with HIV-seropositivity, and served as a direct operant intervention in indirectly enhancing immune system functioning through psychophysiological mechanisms, or by means of the relaxation effect which it produces. Electromyographic-feedback (EMG), was offered only to subjects of the experimental or treatment group, subjects in the control group received no feedback at all. The EMG-feedback sessions took on the following format. A baseline assessment of psychophysiological tension levels, made up of two 5-minute EMG frontalis baseline readings was taken at a pre-treatment stage. The average of these two 5-minute baseline measurements constituted the pre-intervention relaxation level. This baseline assessment was followed by 5-weeks of EMG-feedback assisted relaxation training sessions, of 20-minutes duration per session, with readings been taken at 5-minute intervals. Following the 5-weeks of EMG-feedback assisted relaxation training, a follow-up session composed of two 5-minute recordings was taken again on EMG frontalis to assess the ability of the subjects to relax without direct auditory feedback from the EMG equipment. The effect that the above intervention had on subjects of the experimental or treatment group, will be discussed in the section that follows.

4.5.1 WITHIN-GROUP BASELINE COMPARISONS FOR SUBJECTS OF THE EXPERIMENTAL GROUP.

Within-group comparisons for subjects of the experimental or treatment group, revealed no statistically significant pre-treatment differences in terms of EMG-relaxation\ tension levels. Subjects recordings of baseline EMG levels, varied from 4.5 mv\rms being the highest to 1.60 mv\rms being the lowest. The pre-treatment evaluation further revealed, that subjects who recorded lower EMG-levels, recorded higher CD4-T lymphocyte counts and lower CD8-T lymphocyte counts. This finding would seem to indicate, that HIV-seropositive subjects experiencing higher physiological tension, seem to increase their likelihood of immunosupression and more specifically suppression of cellular immunity. This finding is in keeping with the Gruber et al., (1993) study, which revealed that metastatic cancer subjects with lower EMG levels experienced lower cellular immunosupression and showed the largest increases in cellular immunity, following EMG-biofeedback assisted relaxation training. Another interesting finding in the pre-treatment evaluation, was that subjects who recorded higher EMG levels, also scored higher in the (POMS), factors tension-anxiety, depression-dejection and fatigue-inertia, as well as the Beck Depression Inventory.

4.5.2 WITHIN-GROUP BASELINE TO POST TREATMENT COMPARISONS FOR SUBJECTS OF THE EXPERIMENTAL GROUP.

Within-group baseline to post treatment comparisons revealed some interesting results regarding the effect of the EMG-biofeedback assisted relaxation training intervention on HIV-seropositive experimental subjects. It would appear, that the EMG-feedback assisted relaxation training sessions produced the hypothesized relaxation effects on most of the experimental subjects. During the treatment sessions, 11 of the 14 subjects reached criterion biofeedback levels of 1.5 mv\rms for frontalis muscle EMG. It is also noteworthy, that those individuals who showed the largest drop in EMG levels made the largest gains in immune measures following the EMG-feedback relaxation training sessions.

The above findings are in keeping with the findings by Gruber et al., (1988) and (1993) where an EMG-feedback assisted relaxation intervention combined with guided imagery produced significant immune changes in metastatic cancer patients. The other significant finding in this study, was that there was a trend toward the more stressed subjects as recorded by EMG baseline tension levels, having lower baseline, but higher CD4-T lymphocyte cell counts. This finding is consistent with that found by Snyder et al., (1992) where lymphocyte and other cell mediated immune subsets were lower in subjects that reported higher stress and physiological tension at baseline levels.
The findings in this study are also in keeping with the Peavey et al., (1985) and the Weinman et al., (1983) studies, which found that high stress individuals showed pre to post test changes on physiological tension levels, while low stress subjects showed no such change. The form of treatment for these studies was EMG-feedback assisted relaxation training. The results of the above studies are further consistent with this study, as improvements in phagocytic capacity and overall immune status was observed following the biofeedback training.

Measures on the Profile of Mood States (POMS), also changed for the experimental group following the EMG-feedback sessions, but not for the control group.
The Tension-Anxiety scale showed a significant decrease for the experimental group. As this scale measures heightened musculoskeletal tensions, it was expected to decrease for the experimental group, given the type of treatment-EMG-feedback assisted relaxation training that this group received. Trends were also seen for decreased levels of fatigue-inertia, and for increased vigor-activity, which can be attributed to the combined EMG-feedback relaxation training and aerobic exercise treatments.

4.5.3 WITHIN-GROUP POST TREATMENT TO FOLLOW-UP COMPARISONS FOR SUBJECTS OF THE EXPERIMENTAL GROUP.

Within-group post treatment to follow-up comparisons for subjects of the experimental group showed improvements for high stress subjects only. No significant improvements were observed for subjects that had achieved low physiological EMG-relaxation levels following the EMG-biofeedback assisted relaxation training.

EMG biofeedback treatment gains were however, maintained for high stress subjects while low stress subjects did not change appreciably on follow-up measures of EMG.

On the whole, the results obtained from the EMG-biofeedback assisted relaxation training would seem to indicate that experimental subjects who showed the highest physiological tension and stress levels at baseline assessments, benefited more from the biofeedback training than did low stress subjects. This was revealed in both psychological and immunological measures at post test assessments. Although baseline low stress subjects also benefited from the EMG biofeedback intervention at post test phases, this positive effect was only maintained for high stress subjects at the follow-up assessment phase.

4.6 THE EFFECTS OF THE INDIVIDUALISED COGNITIVE-BEHAVIORAL AND EMG - FEEDBACK INTERVENTION PROGRAM ON PSYCHOLOGICAL FUNCTIONING - IMMUNOLOGICAL INDICES AND HIV-SEROPOSITIVE STATUS.

The data in this study revealed some interesting comparisons between psychological functioning, immunological indices and HIV-seropositive status, as regards the effects of the individualised cognitive behavioral and EMG-feedback intervention.

Even though no statistically significant between-group or pre to post immunological changes were found, except in the case of total lymphocyte counts, contrary to the findings by Antoni et al., (1990) and LaPerriere et al., (1990) the changes in psychological functioning were not all unrelated to immunological functioning. In this regard, the baseline Profile of Mood States (POMS) factor Depression-Dejection (D) was negatively related to total lymphocyte counts, and factor Tension-Anxiety (T) was negatively related to CD4 T-cell counts. There was also a negative correlation between The Beck Depression Inventory and CD4-T lymphocyte counts. The above significant negative correlations would seem to indicate, that the higher the baseline depression and tension-anxiety levels were, the lower the total lymphocyte and CD4-T lymphocyte counts were.

The above results are in keeping with those obtained by Kemmeny et al., (1990) where it was reported that chronic depression precedes a decline in CD4 -T lymphocytes amongst HIV-seropositive men.

The negative correlations that were found between depression and tension-anxiety, and CD4-T lymphocyte counts at baseline measurements also held for post-tests.
More specifically, subjects in the experimental or treatment group that experienced lower levels of depression and tension-anxiety on post-test measures also showed the largest improvements in cell mediated immune indices namely, total lymphocyte and CD4-T lymphocyte immune counts. In subjects of the delayed treatment control group, no such correlations were found on post-test measures, although baseline measures were in keeping with the correlations found in subjects of the treatment group. The above findings would seem to indicate that improved psychological functioning would be related to higher overall CD4-T lymphocyte counts, as the better the patients coped prior to the experimental intervention, the higher the specific T-cells for combating the HIV were. In this regard, previous findings by Reed et al., (1994) found improved psychological functioning and coping ability to be associated with increased morbidity and mortality and would indeed prove true in the case of this analysis. Furthermore, increased depression would be associated with decreased ability of the body to fight the HIV on a psychological level as evidenced by a significant negative correlation between depression and CD4 T-cells on baseline and post-treatment measures. The above findings are in keeping with the Antoni et al., (1990) & LaPerriere et al., (1990) studies as well as the Kiecolt-Glaser & Glaser (1992) and the Wolff et al., (1996) studies.

It would therefore appear from the above results, that decreases in the levels of depression and tension-anxiety brought about a positive change in the overall mood states of the experimental or treatment subjects that could be associated with an increased ability of the body's immunological response to contain the HIV in this context.

More specifically, by increasing the body's immunological response, HIV-seropositve patients also increased their resistance in developing HIV related infections and diseases, and therefore prolonged their asymptomatic or early symptomatic phase of infection. By prolonging their asymptomatic phase of infection, they not only extended their ability to survive longer, but also their quality of life and interpersonal functioning. The above finding is consistent with that obtained by Kemeny et al., (1994) and Lyketsos et al., (1993) where a strong association between CD4-T lymphocytes, depression and HIV-related disease progression was established. Conversely, there have also been a number of studies suggesting that depression is not related to cellular immunity in patients with HIV. Tross & Hirsch (1988) reported lower depression scores in persons with AIDS, who typically had the lowest CD4+T lymphocyte counts, than in those with AIDS Related Complex (ARC). It was further reported that at-risk seronegative subjects had higher depression scores than subjects with ARC (Ostrow, Monjan & Joseph, 1989). These disparate findings can be explained if one considers that no single factor can be used to explain complex psychobiological relationships. Symptoms of depression can be the result of immunosuppression in this population. However, additional psychological and behavioral factors are salient for the individual anticipating seroconversion or progression from one disease stage to another. For example, it has been suggested that higher levels of uncertainty, lack of control, and hopelessness regarding disease progression in earlier stages of infection produce greater psychological distress (Kelly & Murphy, 1992 & Miller, 1990).

Further findings on the more purely psychophysiological measures, indicated that POMS factor Vigor-Activity (V) was negatively correlated with POMS factor Fatigue-Inertia (F) on baseline and post-treatment measures. This finding would seem to indicate, that the higher the baseline and post-test levels of vigor-activity were, the lower the levels of fatigue-inertia were in subjects of both the treatment and control groups. Another interesting finding, was that subjects who scored higher on tension-anxiety levels, also had higher depression levels, and were more fatigued and less vigorous.

The above findings are in keeping with the Eller (1995) and the Wolff et al., (1996) studies, that found similar relationships between psychological and physiological variables in HIV-seropositive patients that were treated with cognitive-behavioral interventions. The above findings would also suggest, that HIV-seropositives who were less vigorous and more fatigued due to their higher levels of depression and anxiety, would experience greater immunosuppressive effects. This would be in keeping with general findings of immune functioning in normal subjects (Roux & Wolff, 1986).

On the whole it would appear, that the pre-test conditions in the relationships between psychological and immunological variables still held for post-test analysis in HIV-seropositive experimental subjects. In this regard, negative psychological states would be associated with immunosuppression as these variables increased in their effectiveness in maintaining negative mood states in the subjects. However, when positive psychological aspects were considered, increases in positive affective mood states were associated with increases in immunological ability to contain the proliferation of the HIV.

An interesting question that arises from the positive psychoimmunological trends experienced by HIV-seropositive subjects, is how the combined cognitive-behavioral, aerobic exercise and EMG-biofeedback intervention modulated the immunologic status of these persons. The answer to this question, lies in several lines of converging evidence suggesting autonomic nervous system and other neuroendocrine mechanisms to explain the documented relationships between the psychosocial stressors, affective distress states and immune functioning as experienced by the asymptomatic and early symptomatic HIV-seropositives. On the one hand, the sympathetic nervous system (SNS) has been proposed as an important immunomodulatory pathway. This is based on evidence for sympathetic noradrenergic innervation of lymphoid organs, the existence of b-adrenergic receptors on lymphocytes and the suppressive effects of epinephrine infusion on lymphocyte proliferative responses in humans (Antoni et al., 1990 & 1991).

On the other hand, stress-associated hormones such as corticosteroids are known to impair several aspects of cellular immunity including the T-lymphocyte cell subpopulation, cytokine production, mitogen responsivity, and NK cell activity, and may do so in HIV-seropositives through lymphocyte transcriptional regulator cytoplasmic receptors (Antoni et al., 1991).

4.7 CONCLUSIONS.

On the whole, the hypotheses for this study were partially supported. In this regard, the results of the research revealed no significant between-group differences in any of the cellular immune measurements. Clinically and statistically significant increases in pre to post-test measures of total lymphocyte cellular immune counts in experimental subjects were however found. Statistically significant between-group differences were also found in the tension-anxiety, depression-dejection, fatigue-inertia and vigor-activity levels of the experimental subjects, as compared to the delayed treatment control group subjects. The study further revealed, that subjects who recorded lower depression and tension-anxiety levels at baseline and post-intervention phases had higher CD4 -T lymphocyte counts, and therefore, increased resistance to HIV-related infections and diseases.

The study further revealed significant within-group differences in terms of the baseline to post-test relaxation effect of the EMG-feedback assisted relaxation training, as well as clinically significant within-group increases in the CD4-T lymphocyte counts of experimental subjects who experienced this relaxation effect. Exactly how EMG-feedback assisted relaxation training affected the immune response is speculative. Training may have directly affected the cognitive processes of the subjects. Possibly, relaxation training cognitively changed the subject's expectation for being able to cope with stressors, or since relaxation is a skill, it may have given subjects the necessary tools to cope or adapt with a stressful environment. If EMG-feedback assisted relaxation training increases coping ability or adaptive functioning, it is unknown how this cognitive process affects immune cell activity.

Biofeedback-assisted relaxation does however, lead to lowered general arousal, decreased muscle tension, and an increase in peripheral blood flow. This relaxation produces decreased sympathetic activity and decreases secretion of adrenaline. Perhaps EMG - feedback assisted relaxation training through the hormonal system, reduced adrenaline levels and affected adherence, chemotaxis, and / or lysosome membrane permeability. Since oxygen is an absolute requirement for the ingestion of foreign material, it could be that biofeedback-assisted relaxation enhances the oxidative abilities of neutrophils. Whatever the mechanism of enhancement, it appears that biofeedback-assisted relaxation can affect immune cell capacity.

In addition to the purely immunological positive trends, significant changes were found in psychosocial variables related to specific psychophysiological functioning. It would then also appear, that these indices were related to immunological functioning. Of further note, was the finding that increased coping and positive increases in affective mood states were associated with increased ability to contain the proliferation of the HIV. The negative emotional states and interpersonal emotional states were also related as it would have appeared in non HIV infected persons. The normal psychoimmunological variables held in the sense, that increased negative mood states would be related to increased suppression of immunological variables.

In summary, the predicted hypotheses for this study were partially confirmed. In this regard, it would appear that the individualised cognitive-behavioral intervention combined with aerobic exercise and EMG-feedback assisted relaxation training led to health and/or disease specific changes in the HIV-seropositive status of experimental subjects. It would also appear, that the biopsychosocial treatment model utilised in this study, may be more feasible for anxious, depressed asymptomatic or mildly symptomatic HIV-seropositive patients who can attend weekly sessions without any difficulty. HIV-seropositive patients with more advanced or later clinical-stage illness may lack the stamina and energy to participate in any extra treatments, other than those prescribed by the medical practitioner, or may already be taking low doses of antidepressants or anxiety reducing medications.

Another important aspect to consider, is that persons representing with clinical AIDS symptoms in many instances, lack the mental capacity to benefit from psychotherapeutic or other behavioral interventions.

In conclusion, the ability to intentionally modulate immune system parameters in HIV-seropositives through biopsychosocial treatment strategies appears to be a possibility. The above intervention demonstrated that the reduction of burdensome psychosocial and psychophysiological stressors had a positive impact on immune system functioning amongst HIV-seropositives. In this regard, the findings that lower levels of psychological distress are associated with higher levels of immune functioning in these persons, and therefore an acceleration in the implementation of natural defense mechanisms is supported. These findings are however limited to asymptomatic and early symptomatic HIV-seropositives, and should not be generalised to other categories of AIDS sufferers. It is also important to note, that further well-controlled research with larger samples and more sensitive measures is needed to confirm and expand this finding.

REFERENCE LIST.

Ader, R., Felter, D.L., Cohen, N. (Eds.). (1991). Psychoneuroimmunology, (2nd ed.) San Diego: Academic Press.

Ahmed, P. (1992). Living and Dying with AIDS. New York: Plenum Press.

Allport, G.W. (1966). Traits revised. American Psychologist, 21, 1-10.

Antoni, H.M., Schneiderman, N., Fletcher, M.A., Goldstein, D.A., Ironson, G., & Laperriere, A. (1990). Psychoneuroimmunology and HIV-1. Journal of Consulting and Clinical Psychology, 58 (1), 38-49.

Antoni, M.H., Baggett, L., Ironson, G., LaPerriere, A., August, S., Klimas, N., Schneiderman, N. & Fletcher, M.A. (1991). Cognitive-behavioural stress management intervention buffers distress responses and immunologic changes following notification of HIV-1 seropositivity. Journal of Consulting and Clinical Psychology, 59(6), 906-915.

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Auerbach, J.E., Oleson, T.D., Solomon, G.F. (1992). Biofeedback, guided imagery, and hypnosis as an adjunctive treatment for AIDS and AIDS-related complex. Proceedings of the Third National Conference on the Psychology of Health, Immunity, and Disease. Storrs, CT: The National Institute for the Clinical Application of Behavioral Medicine, 50

Aveline, M. (1992). From Medicine to Psychotherapy. London: Whurr Publishers.

Bagdades, E.K. (1991). Current treatment of opportunistic infections in HIV disease. AIDS Care. 3, (1) 461-466.

Bahrke, M., & Morgan, W.P. (1978). Anxiety reduction following exercise and medication. Cognitive Therapy and Research, 2, 323-333.

Bandura, A. (1987). Perceived self-efficiency in the exercise of control over AIDS infection. Paper presented at the National Institute of Mental Health and Drug Abuse Research Conference on Women and AIDS, Promoting Health Behaviours, Bethesda MD.

Barnett, T., & Blaikie, D. (1992). Aids In Africa: its present and future impact. London: Belhaven Press. Clinical Health Psychology.

Basmajian, J.V. (Ed.). (1979). Biofeedback - Principles and practice for Clinicians. Baltimore: Williams and Wilkins.

Baum, A., McKinnon, Q., & Silvia, C. (1987). Chronic stress and the immune system. Paper presented at the Eighth Annual Scientific Meeting of the Society of Behavioral Medicine, Washigton, DC.

Beck, A.T., Ward, C.H., Mendelson, M., Mock, J & Erbaugh, J. (1961). Archives of General Psychiatry, Vol 4.

Bennett (1987). AIDS and the Education of Our Children: A Guide for Parents and Teachers. Washington DC, U.S. Department of Education.

Benson, H. (1983). The relaxation response and norepinephrine. Integrative Psychiatry, 1, 15-18.

Berger, R.M. (1990). Men Together: Understanding the Gay Couple. Journal of Homosexuality, 19 (3), 31-49.

Berkelman, R.L., Heyward, W.L., Stehr-Green, J.K., Curran, J.W. (1989). Epidemiology of Human Immunodeficiency Virus Infection and Acquired Immunodeficiency Syndrome. American Medical Journal, 86, 761-770.

Blendon, R.J. & Donelan, K. (1988). Discrimination Against People with AIDS, The Public's Perspective. Journal of Medicine, 319, 1022-1026.

Bolognesi, D.P. (1992), in Giraldo, G managing (ed), Rossi, G.B., Beth-Giraldo, E., Chieco-Bianchi, L., Dianzani, F., Giraldo, G., and Verani, P.(ed). Science Challenging AIDS. Karger Publishers.

Bor, R. & Miller, R. (1988). Addressing "Dreaded Issues" : A description of a unique counselling intervention with patients with AIDS/HIV. Counselling Psychology Quarterly, 4, 397 - 405.

Borden, W. (1991). Beneficial outcomes in adjustment to HIV seropositivity. Social Service Review, 434-448.

Buckingham, S.L. (1987). The HIV Antibody Test: Psychosocial Issues. Social Case Work, 68, 387-393.

Budzynski, T. (1973). Biofeedback procedures in the clinic. Seminars in Psychiatry, 5, 537-547.

Budzynski, T.H. (1977). Clinical Implication of Electromyographic Training in Schwartz and Beatty (Ed). Biofeedback Theory and Research. Academic Press. New York.

Cameron, D.W., Plummer, F.A., Simonsen, J.N., Ndinya-Achola, J., D'Costa. L.J., & Piot, P. (1987, June). Female and Male heterosexual transmission of HIV infection in Nairobi (Abstract MP.91). Paper presented at the Third International Conference on AIDS, Washington, DC.

Canter, A., Kondo, C.Y., & Knott, J.R. (1975). A comparison of EMG feedback and progressive muscle relaxation training in anxiety neurosis. British Journal of Psychiatry, 127, 470-477.

Cassidy, M.J. & Schlebush, L. (1993). Biopsychosocial factors in HIV-AIDS: psychoneuroimmunological implications. African Journal of Neurosciences, 1, 11.

Castro, K.G., Lieb, S., Jaffe, H.W., Narkunas, J.P., Calisher, C.H., Bush, T.J., & Witte, J.J. (1988). Transmission of HIV in Belle Glade, Florida: Lessons for other communities in the United States. Science, 239, 193-197.

Catt, S., Stygall, J., & Catalan, J. (1995). Acceptance of Zidovudine (AZT) in early HIV disease: the role of health beliefs. AIDS Care. 7. (2) 229-234.

Centers for Disease Control. (1985). Provisional Public Health Service interagency recommendations for the Centers for Disease Control screening donated blood and plasma for antibody to the virus causing acquired immunodeficiency syndrome. Morbidity and Mortality Weekly Report, 34, 1-5.

Centers for Disease Control. (1987c). Human immunodeficiency virus infection in the United States: A review of current knowledge. Morbidity and Mortality Weekly Report, 36(S-6), 1-47.

Centers for Disease Control. (1987d). Human immunodeficiency virus infection transmitted from an organ donor screened for HIV antibody: North Carolina. Morbidity and Mortality Weekly Report, 36, 306-308, 314-315.

Centers for Disease Control. (1988c). Safety of therapeutic products used for hemophilia patients. Morbidity and Mortality Weekly Report, 37, 441-444.

Centers for Disease Control. (1989, June 18). AIDS weekly Surveilance Report: United States.

Chmiel, J.S., Detels, R., Kaslow, R., Van Raden, M., Kingsley, L.A., Brookmeyer, R., & the Multicenter AIDS Cohort Study Group. (1987). Factors associated with prevalent human immunodeficiency virus (HIV) infection in the multicenter AIDS Cohort Study. American Journal of Epidemiology, 126, 568-577.

Chrousos,G.P. & Gold, P.W. (1992). The concepts of stress and stress disorders: Overview of physical and behavioural homeostasis. JAMA 267, 1244-1252.

Chuang, H., Devins, G., Hunsley, J. & Gill, M. (1989).Psychosocial Distress and Well-being Among Gay and Bisexual Men with Human Immunodeficiency Virus Infection American Journal of Psychiatry, 146, (7).

Clement, M., Hollander, H. (1992). Natural history and management of the seropositive patient. In Sande MA, Volberding PA (eds), The Medical Management of AIDS. Philadelphia, PA: Saunders, 87-96.

Coates, T.J., Temoshok, L. & Mandel, J. (1984). Psychosocial research is essential to understanding and treating AIDS. American Psychologist, 39(11), 1309-1314

Cohen, P.T., Sande, M.E., Volberding, P.A.(ed). (1990). The AIDS Knowledge Base. A Textbook On HIV Disease from the University of California, San Francisco General Hospital. Waltham, Massachusetts.

Cohen, S., & Williamson, G.M. (1991). Stress and infectious disease in humans. Psychol Bull. 109, 5-24.

Collier, AC., Bozzette, S., Coobs, R.W. (1990). A pilot study of low dose zidovudine in human immunodeficiency virus infection. New England Journal of medicine, 323, 1015-1021.

Conant, M., Hardy, D., Sernatinger, J., Spicer, D., & Levy, J. (1986). Condoms prevent transmission of AIDS-associated virus. Journal of the American Medical Association, 225, 1706.

Crew, M. (1992). AIDS in South Africa. The myth and the reality. London: Penguin Books.

Danskin, D.G., & Crow, M.A. (1981). Biofeedback, An Introduction and Guide. Mayfield Publishing.

Davis, H. (1986). Effects of Biofeedback and Cognitive Therapy on Stress in Patients with Breast Cancer. Psychological Reports. 59, 967-974.

De Jongh van Arkel, J. (1991), (ed). Living in an AIDS Culture. Pretoria: Unisa

Dommisse, J. (1987). The state of psychiatry in South Africa today. Social Scientific Medicine, 24, 741-761.

Doob, P.R., MacFadden, D.K. (1992). The impact of peptide T on HIV - related fatigue and health-related quality of life. The Eighth International Conference on AIDS, (Abstract no. PuB 7149.) Amsterdam:

Earl, W. Martindale, C. & Cohn, D. (1991). Adjustment Denial in the Styles of Coping with HIV Infection. Omega, 24 (1), 35-47.

Eller, L.S. (1995). Effects of two Cognitive-Behavioral interventions on Immunity and Symptoms in persons with HIV. Annals of Behavioral Medicine. 17, (4) 339-348.

Epidemiological Comments. (1994, November). 21(11)

Epidemiological Comments.(1995, June). 22(6)

Evian, C. (1993). Primary AIDS Care. Jacana Johannesburg.

Fischl, M.A., Richman, D., Grieco, M., Volberding, P., Laskin, O., Leedom, J., Groopman, J., Mildvan, D., Schooley, R., Jackson, G., Durack, D., & King, D. (1987). The efficacy of azidothymidine (AZT) in the treatment of patients with AIDS and AIDS-related complex. New England Journal of Medicine, 317, 185-191.

Fitzgerald, L. (1991). Overtraining increases susceptibility to infection. International Journal of Sports Medicine, 12, 5-8.

Fox, R., Eldred, L.J., Fuchs, E.J. (1987). Clinical manifestations of acute infection with human immunodeficiency virus in a cohort of gay men. AIDS. 1, 35-38.

Gatchel, R.J., & Price, K.P. (1979). Clinical Applications of Biofeedback Appraisal and Status. Pergamon Press. New York.

Gatewood-colwell, G., Kaczmarek, M. & Ames, M.H. (1989). Reliability and Validity of the Beck Depression Inventory for white and Mexican-American Gerontic Populations. Psychology Report. 65, 1163-1166.

Giraldo, G. (1992). (Managing Editor). Science Challenging AIDS. Switzerland, Basel: Karger.

Glasner, P.D., & Kaslow, R.A. (1990). The epidemiology of human immunodeficiency virus infection. Journal of Consulting and Clinical Psychology, 58, 13-21.

Goldwater, B., & Collis, M. (1985). Psychological effects of cardiovascular conditioning: a controlled experiment. Psychosocial Medicine, 47, 174-181.

Goodkin, K. (1988). Psychiatric aspects of HIV infection. Texas Medicine, 84 (9), 55-61.

Grant, I., & Heaton, K. (1990).Human Immunodeficiency Virus-Type 1 (HIV-1) and the Brain. Journal of Consulting and Clinical Psychology, 58. (1) 22-30.

Gruber, B.L., Hall, N.R., Hersch, S.P., & Dubois, P. (1988). Immune system and psychological changes in metastatic cancer patients while using ritualized relaxation and guided imagery. Scandinavian Journal of Behaviour Therapy, 17, 25-46.

Gruber, B.L., Hersh, S.P., Hall, N.R.S., Waletzky, L.R., Kunz, J.F., Carpenter, J.K., Kverno, S.K., & Weiss, S.M. (1993). Immunological Responses of Breast Cancer Patients to Behavioural Interventions. Biofeedback and Self-Regulation. 18 (4)1-20

Grummon, K.; Rigby, E.D.; Orr, D.; Procidano, M & Reznikoff, M. (1994). Psychosocial variables that affect the psychological adjustment of IVDU Patients with AIDS. Journal of Clinical Psychology, July 1994. 50, (4).

Halley, M.(1991). Self-Regulation of the Immune System Through Biobehavioral Strategies. Biofeedback and Self-regulation, 16, (1). 55-74

Hanson, P.G. & Flaherty, D.K. (1981). Immunological responses to training in conditioned males. Clinical Science. 60, 225-228.

Hays, R ., Catania, J ., Mckusick, L and Coates, T (1990).
Help - seeking for AIDS - Related Concerns: A Comparison of Gay Men with Various HIV Diagnoses. American Journal of Community Psychology. 18, (5).

Hays, R ., Turner, H ., & Coates, T (1992). Social Support, AIDS - Related Symptoms and Depression Among Gay Men. Journal of Consulting and Clinical Psychology, 60, (3), 463-469.

Hedfors, E., Holm, G., Ivansen, M., & Wahren, J. (1983). Psychological variation of blood lymphocyte reactivity: T-cell subsets, immunoglobulin production, and mixed-lymphocyte reactivity. Clinical Immunological Immunopathology, 27, 9-14.

Herbert, T.B., Cohen, S. (1993). Depression and immunity: A metaanalytic review. Psychological Bulletin, 113, 472-486.

Herek, G. & Glunt, E. (1988). An Epidemic of Stigma: Public Reactions to AIDS. American Psychologist, 43 (11), 886-892.

Hoffman, W.W. & Genz, S.J. (1990). AIDS Ministry in the midst of an epidemic. Grand Rapids Michigan: Baker Book House.

Hoffman, M. (1991). Counselling the HIV - Infected Client. The Counselling Psychologist, 19 (4), 467-542.

Ijssenlmuiden, CB., Steinberg, MH., Padayachee, GN., Schob, BD., Strauss, SA., Buxh, E.. Davies,JCA., DeBeer, C., Gear, JSS. & Hurwitz, HS., (1988). Aids and South Africa - Towards a Comprehensive Strategy. South African Medical Journal, 73, 455-467.

Ironson, G. , LaPerriere, A., Antoni, M., O'Hearn, P., Schneiderman, N., Klimas, N. & Fletcher, M.A. (1990). Changes in immune and psychological measures as a function of anticipation and reaction to news of HIV-1 antibody status. Psychosomatic Medicine, 52, 247-270.

Jacobsen, B.P., Perry, S.W., Hirsch, D.A. (1990). Behavioural and Psychological Responses to HIV Antibody Testing. Journal of Consulting and Clinical Psychology. 58 (1), 31-37.

Jasnoski, M.L., & Kugler, J. (1987). Relaxation, imagery, and neuroimmunomodulation. Annals of the New York Academy of Sciences, 496, 722-730.

Jensen, M.M & Wright, D.N. (1989). Introduction to Microbiology for the Health Sciences. (Second Edition). Prentice-Hall International, INC.

Johnsgard, K.W. (1989). The Exercise Prescription for Depression and Anxiety. Plenum Press, New York and London.

Kaplan R.M., Sallis, J.F & Patterson, T.L. (1993). Health and Human Behaviour. McGraw-Hill International Editions.

Kaplan, H.I., Sadock, B.J., & Grebb, J.A. (1994). Synopsis of Psychiatry Behavioural Sciences Clinical Psychiatry. (7th Edition). Williams and Wilkins Publishing.

Kappes, B., & Michaud, J. (1978). Contingent versus noncontingent EMG feedback and hand temperature in relation to anxiety and locus of control. Biofeedback and Self Regulation, 3, 51-60.

Kelly, J.A. & Murphy, D.A. (1992). Psychological Interventions With AIDS and HIV: Prevention and Treatment. Journal of Consulting and Clinical Psychology, 60 (4), 576-585.

Kelly, J.A., Murphy, D.A., Bahr, G.R., Kalichman, S.C., Morgan, M.G., Stevenson, Y., Koob, J.J., Brasfield, T.L., & Bernstein, B.M. (1993, November). Outcome of Cognitive-Behavioural and Support Group Brief Therapies for the Depressed, HIV-Infected Persons. American Journal of Psychiatry. 150 (11) 1679-1685.

Kemmeny, M.E., Duran, R., Weiner, H., Taylor, S., Visscher, B., & Fahey, J.L. (1989). Changes in lymphocyte phenotype and function in HIV seropositive homosexual men following the death of a partner. Presented at the Fifth International Conference on AIDS, Montreal, Canada, June 4-9.

Kemmeny, M.E., Duran, R., Weiner, H., Taylor, S., Visscher, B., & Fahey, J.L. (1990). Chronic depression precedes a decline in CD4 helper/inducer T cells in HIV positive men. Cited in Ader, R., Felton, Cohen (Ed.). (1991). Psychoneuroimmunology, second edition. New York: Academic Press.

Kemeny, M.E., Weiner, H., Taylor, S.E.(1994). Repeated bereavement depressed mood, and immune parameters in HIV seropositive and seronegative gay men. Health Psychology. 13, 14-24.

Kessler, H.A., & Harris, A.A. (1992). Therapy of Human Immunodeficiency Virus. Textbook of Clinical Neuropharmacology and Therapeutics. (Second Edition). Edited by H.L. Klawans et al., Raven Press, Ltd., New York.

Kiecolt-Glaser, J.K., Garner, W., Speicher, C.E., Penn, G., and Glaser, R. (1984). Psychosocial modifiers of immunocompetence in medical students. Psychosomatic Medicine, 46, 7-14.

Kiecolt-Glaser, J.K., Glaser, R., Strain, E., Strout, J., Tarr, K., Holliday, J., & Speicher, C.E. (1986). Modulation of cellular immunity in medical students. Journal of Behavioral Medicine, 9, 5-21.

Kiecolt-Glaser, J.K. & Glaser, G. (1992). Psychoneuroimmunology: can psychological interventions modulate immunity. Journal of Counsulting and Clinical Psychology. 60(4), 569-577.

Klatt, E.C. (1992). Practical AIDS pathology. A.S.C.P. Press Chicago.

Kropiunigg, U. (1993). Basics in Psychoneuroimmunology. Annals of Medicine, 25: 473-479.

Kurdek, L. (1988). Perceived Social Support in Gays and Lesbians in Co-habitating Relationships. Journal of Personality and Social Psychology, 54 (3), 504-509.

Kurdek, L. (1991). Correlates of Relationship Satisfaction in Cohabiting Gay and Lesbian Couples: Integration of Contextual, Investment and Problem - Solving Models. Journal of Personality and Social Psychology, 54 (3), 504-509

Lachman, S.J (1991). The Emergent Reality Of Heterosexual HIV / AIDS. A primer for medical practitioners and health care workers. Lennon Limited.

Landmann, R.M., Muller, F.B., Perini, C.H. (1984). Changes of immunoregulatory cells induced by psychological and physical stress: Relationship to plasma catecholamines. Clinical Experimental Immunology, 58, 127-135.

LaPerriere, A., Schneiderman, N., Antoni, M.H., & Fletcher , M.A. (1990) Aerobic Exercise Training and Psychoneuroimmunology. In L. Temoshok., A. Baum., & L. Erlbaum (Eds.), Psychological perspectives on AIDS: Etiology, Prevention and Treatment. Associates, Publishers Hillsdale, New Jersey.

Lavallee, Y.L., Lamontangne, Y., Pinard, G., Annable, L., & Tetreault L. (1977). Effects on EMG feedback, diazepam, and their combination on chronic anxiety. Journal of Psychosomatic Research, 21, 65-71.

Levinson. W.E. & Jawetz, E. (1994). Medical Microbiology and Immunology. Lang Medical Book.

Levy, JA. (1992). Viral and immunologic factors in HIV infection. In Sande MA, Volberding PA (eds), The Medical Management of AIDS. Philadelphia, PA: Saunders, 18-32.

Lewis, J.A., Sperry, L. & Carlson, J. (1993). Health Counselling. California: Brooks/Cole Publishing Company.

Lindegger, G., Wood, G. (1995, March). The AIDS crisis: review of psychological issues and implications with special reference to the South African situation. South African Journal of Psychology. 25, (1), 1-9.

Livingstone, B. (1988). AIDS: psychological and social perspectives. Critical Health, 22, 29-33.

Lopez, D.J. & Getzel, G.S. (1984). Helping Gay AIDS Patients in Crisis. Social Casework, 65, 387-394.

Lovejoy, N. (1992). AIDS. Impact on the Gay Man's Homosexual and Heterosexual Families. Homosexuality and Family Relations, 285-311.

Longo, M.B., Spross, J.A., Locke, A.M. (1990). Identifying major concerns of persons with AIDS. Clinical Nurse Specialist, 4, 21-26.

Lyketsos, C.G., Hoover, D.R., Guccione, M. (1993). Depressive symptoms as predictors of medical outcomes in HIV. Journal of the American Medical Association, 270, 2563-2567.

Lyons, S.F. (1993). Evaluation of rapid enzyme immunobinding assays for the detection of antibodies to HIV-1. South African Medical Journal. 83, 1-76

Manuck, S.B., Cohen, S., Rabin, B.S. (1991). Individual differences in cellular immune responses to stress. Psychological Science, 2, 111-115.

Mays, V.M., Albee, G.W. & Schneider, S.F. (Eds.). (1989). Primary prevention of AIDS: psychological approaches. London: Sage Publications.

McCann, K. & Wadsworth, E. (1991). The experience of having a positive HIV antibody test. AIDS Care. 3 (1), 43-52.

McCutchan, J.A. (1990). Virology, Immunology and Clinical Course of HIV Infection. Journal of Consulting and Clinical Psychology. 58, (1) 5-12.

McNair, D.M. Lorr, M. & Droppleman, L.F. (1992). Edits Manual for the Profile of Mood States. Published by Edits/Educational and Industrial Testing Services San Diego, California 92167.

Miller, D. (1990). Diagnosis and treatment of acute psychological problems related to HIV infection and disease. In D.G. Ostrow. (ed), Behavioural Aspects of AIDS. Plenum Publishing corporation New York.

Miller, D. (1987). Living with AIDS and HIV. Hampshire: MacMillan Press.

Miller, L. (November, 1989). What Biofeedback Does (and Doesn't) Do. Psychology Today. 22-24.

Mischel, W. (1968). Personality and Assessment. New York: Wiley.

Moos, R. (1988). Coping with Life Crisis. New York: Plenum Press.

Moynihan, R. Christ, G. & Silver, L.G. (1988). AIDS and Terminal Illness. Social Casework, 380-387.

Namir, S., Wolcott, D.L., Fawzy, F.I., & Alumbaugh, M.J. (1987). Coping with AIDS: Psychological and health implications, Special Issue: Acquired Immune Deficiency Syndrome. Journal of Applied Social Psychology, 17, 309-328.

Neugarten, B. (1979). Time, Age and the Life Cycle. American Journal of Psychiatry, 136, 887-894.

Newton, T.F., Leuchter, A.F., Walter, D.O., van Gorp, W.G., Morgenstern, H., Miller, E.N., Lieb, K., Visscher, B., Satz, P., & Weiner, H. (1993). Electroencephalographic Coherence in Acquired Immune Deficiency Syndrome. Psychiatry Research. 54. (1) 1-11.

Nicholson, W.D., & Long, B.C. (1990). Self-Esteem, Social Support, Internalized Homophobia, and Coping Strategies of HIV+ Gay Men. Journal of Consulting and Clinical Psychology. 58 (6). 873-876.

O'Connell, P.G. (1990) Productive Living Strategies for People with AIDS. In Johnson, A.J. (ed) & Pizzi, M. (guest ed). Harrington Park Press New York- London. (pp. 20-41).

O'Leary, A.(1990). Stress, emotion, and human immune function. Psychological Bulletin, 108, 363-382

Ostrow, D.G., Monjan, A., Joseph, J. (1989). HIV-related symptoms and psychological functioning in a cohort of homosexual men. American Journal of Psychiatry. 146, 737-742.

Peavey, B.S., Lawlis, G.F., & Goven, A. (1985) Biofeedback-Assisted Relaxation: Effects on Phagocytic Capacity. Biofeedback and Self-Regulation, 10, (1) 33-45.

Pergami, A., Catalan, J., Hulme, N., Burgess, A., & Gazzard, B. (1994). How should a positive HIV result be given? The patients view. AIDS Care. 6 (1), 21-27.

Perry, S.W., Tross, S. (1984). Psychiatric problems of AIDS in-patients at the New York Hospital: A preliminary report. Public Health Reports. 99, 200-205.

Pizzi, M. & Johnson, J. (1990), (ed). Productive Living Strategies for People with AIDS. New York: Harrington Park Press. (Pp. 20-41).

Price, R.E., Omizo, M.M. & Hammett, V.L. (1986, October). In the Field: Counselling Clients with AIDS. Journal of Counselling & Development, 65 (1), 96-97

Pudifin, D.J., Duursma, J. & Prior, C.R.B. (1990). The clinical and lymphocyte status of HIV antibody-positive black blood donors. South African Medical Journal, 77, 628-629.

Rabkin, J.G., Williamson, J.B., Remier, R.H. (1991). Depression, distress, lymphocyte subsets, and human immunodeficiency virus symptoms on two occasions in HIV-positive homosexual men. Archives of General Psychiatry. 48, 111-119.

Reed, T.M., Kemeny, M.E., Taylor, S.E., Wang, H.J & Visscher, B.R (1994). Realistic acceptance as a predictor of decreased survival time in gay men with AIDS. Health Psychology, 13 (4), 299-307.

Reiss, D. & Kaplan de Nour, A. (1989). The Family and Medical Team in Chronic Illness. In C.N. Ramsey Jr (Ed). Family Systems in Medicine. New York: Guilford, 435-444.

Rice, K.M., & Blanchard, E.B. (1982). Biofeedback in the treatment of anxiety disorders. In R.J. Mathew (Ed), The biology of anxiety. New York: Brunner/Mazel.

Robertson, K.R., Wilkins, J.W., Handy, J., Van der Horst, C., Robertson, W.T., Fryer, J.G., Evans, D., & Hall, C.D. (1993). Psychoimmunology and AIDS: Psychological Distress and Herpes Simplex Virus in Human Immunodeficiency Virus Infected Individuals. Psychology and Health, 8, 317-327.

Rodin, G., Craven, J., Littlefield, C. (1991). Depression in the Medically Ill. New York: Brunner/Mazel.

Roitt, I., Brostoff, J., Male, D. (1994). Immunology. St.Louis, MO: Mosby.

Ryan, A.J. (1983). The Physician and Sports Medicine 11:10

Saag, M.S. (1992). AIDS testing. Now in the Future. In Sande MA, Volberding PA (eds), The Medical Management of AIDS. Philadelphia, PA: Saunders, 33-53.

Schopper, D. & Walley, J. (1992). Care for AIDS patients in developing Countries: A Review. Aids Care. 4 (1) 89-101.

Schall, R. (1990). On the maximum size of AIDS epidemic among the Heterosexual black population in South Africa. South African Medical Journal, 78, 507-510.

Schlebusch, L. & Cassidy, M.J. (1995). Stress, social support and biopsychosocial dynamics in HIV-AIDS. South African Journal of Psychology. 25 (1).

Schneiderman, N. (1992). Aerobic exercise intervention in a multiethnic sample of early symptomatic HIV-1 infected men and women. Research proposal for 1993.

Schwartz, M.S. & Associates, (1987). Biofeedback, A Practitioner's Guide. The Guilford Press.

Shapiro, D., & Schwartz, G.E. (1972). Biofeedback and visceral learning: Clinical applications. Seminars in Psychiatry, 4, 171-184.

Scott, M. (1989). A Cognitive-behavioural Approach to Clients'Problems. Tavistock/Routledge. London and New York.

Schwartz, G.E., & Beatty, J. (1977). Biofeedback, Theory and Research. Academic Press. New York.

Sharkey, B.J. (1990). Physiology of Fitness (Third Edition), Human Kinetics Books Champaign, Illinois.

Silverman, D.C. (1993). Psychosocial Impact of HIV Related Caregiving on Health Providers: A Review and Recommendation for the Role of Psychiatry. American Journal of Psychiatry, 150, 5, May 1993.

Simon, H. (1984). The immunology of exercise. A brief review. Journal of the American Medical Association, 252, 2735-2738.

Smerczak, L. (1991, November). This baby has AIDS. Femina, 55-58.

Snyder, B.K., Roghmann, K.J., & Sigal, L. H. (1992). Stress and Psychosocial Factors: Effects on Primary Cellular Immune Response. Journal of Behavioral Medicine, 16 (2).

Solomon, G.F., Temoshok, L. (1987). A Psychoneuroimmunologic Perspective on AIDS research: Questions, Preliminary findings and suggestions. Journal of Applied Social Psychology. 17(3), 286-308.

Solomon, G.F., Kemeny, M.E., and Temoshok, L. (1991). Psychoneuroimmunologic aspects of Human Immunodeficiency Virus Infection. In Ader, Cohen, Felton (Eds), Psychoneuroimmunology, 2nd ed., (pp. 1081-1113). New York: Academic Press.

Govender, M., Marimuthu, T., Bubb, M.O., Conradie, J.D. (1985). Safer blood - supplementation of blood products with anti-HBs. South African Medical Journal, 68, 295-298.

Speilberger, C.D. (1975). State-Trait Process. In C.D. Speilberger and I.G. Sarason (Eds). Stress and Anxiety. New York: Wiley.

Steere, J. (1984). Ethics in clinical psychology. Cape Town: Oxford University Press.

Stites, D.P., Terr, A.I., Parlow, T.G. (1994). Basic Clinical Immunology. Norwalk, CT: Appleton Lange.

Taylor, S. (1983). Adjustment to Threatening Events: A Theory of Cognitive Adaptation. American Psychologist, 38, 1161-1173.

Temoshok, L ., Baum, A., Erlbaum, L (Eds), (1987), Pychological Perspectives on AIDS. Etiology, Prevention and Treatment. 259-279. Associates publishers Hillsdale, New Jersey.

Teshima, H., Sogawa, H., Kihara, S., Nagata, S., Ago, Y., & Nakagawa, T. (1987). Changes in populations of T cell subsets due to stress. Annals of the New York Academy of Sciences, 496, 459-466.

Townsend, R.E., House, J.F., & Addario, D.A. (1975). A comparison of biofeedback-mediated relaxation and group therapy in the treatment of chronic anxiety. American Journal of Psychiatry, 132, 598-601.

Tross, S., Hirsch, D.A. (1988). Psychological distress and neuropsychological complications of HIV infection and AIDS. American Psychologist. 43, 929-934.

Tross, S. (1990). Neuropsychological Impairment in AIDS. Psychosocial perspectives on AIDS. Temoshok & Baun (1990) ed.

Villee, C.A., Solomon, E.P., Martin, C.E., Martin, D.W., Berg, L.R., Davis, P.W. (1985). Biology (Second Edition). Saunders College Publishing.

Watson, R., Moriguchi, S., Jackson, J. (1986). Modification of cellular immune functions in humans by endurance training during B-adrenergic blockade with atenolol or propranolol. Medicine and Science in Sports and Exercise, 18, 95-100.

Weinman, M.L., Semchuk, K.M., Gaebe, G., & Mathew, R.J. (1983). The Effect of Stressful Life Events on EMG Biofeedback and Relaxation Training in the Treatment of Anxiety. Biofeedback and Self-Regulation, 8, (2).

Weiss, R. (1988). The Experience of AIDS: Hypnosis Based on Pilot Study Interviews. Journal of Palliative Care, 4 (4), 15-25.

Weisse, C.S. (1992). Depression and immunocompetence: a review of the literature. Psychological Bulletin, 111(3), 475-489.

Williams, C., Lubeck, D.P. (1993). HIV related fatigue. The Ninth International Conference on AIDS, (Abstract No. PO-B01-0885). Berlin, Germany:

Wolff, E., Messinis, L., Lamb, T., LaPerriere, A. (1996). A cross-cultural examination of a Group-Based Cognitive-Behavioral and Exercise intervention in HIV-1 infected persons. Annals of Behavioral Medicine. (18), 83

Wolff, E & Roux, A. (1986). Learned helplessness, depression and physical illness: An Experimental investigation into behavioral immunology. Presented at the 20th Annual Association for the Advancement of Behavior Therapy Convention, Chicago, II. 1986.

Zich, J. & Temoshok, L (1987). Perceptions of Social Support in Men with AIDS and ARC: Relationships with Distress and Hardiness. Journal of Applied Social Psychology, 17, 193-215.

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APPENDIX A

INFORMED CONSENT

FOR SUBJECT PARTICIPATION IN A RESEARCH STUDY

The effects of an individualised cognitive-behavioral and electromyographic-feedback intervention on HIV-seropositive patients.

PURPOSE: The purpose of this study is, to evaluate the effects of an 8-week ergometric aerobic exercise intervention combined with Electromyographic-feedback relaxation training and cognitive-behavioral therapy, on certain psychological and immunological variables related to symptoms in the asymptomatic (no symptoms) and early symptomatic (few symptoms) stages of HIV\ AIDS infection. You are invited to participate, if you fulfill admission criteria, and if you are willing and able to comply with the necessary requirements of the program. This form serves as a request for your participation in this program.

PROCEDURES: This intervention will span over an 8-week period and will take place at the Clinic and Center for Behavioral Medicine at the Rand Afrikaans University. If you agree to participate in this intervention, you will be asked to report to the Clinic, affiliated to the Rand Afrikaans University (RAU), and be required to complete several psychological questionnaires covering aspects related to your physical and psychological health, and more specifically how you relate to stress, anxiety, and social coping, before and after your infection with the virus that causes AIDS. Questions regarding your sexual and medical history may also be asked, and whether you make use of any medications, or any other substances.

A physical examination, including a maximum graded bicycle exercise test will form part of the procedures. If you are selected to participate in this program you will be required to repeat the above procedures after an 8-week period. You will also be required to attend two meetings a week over the 8-week period and the exact days will be allocated to you at the first meeting.
The duration for each meeting will be approximately one and a half to two hours. Individual therapy sessions (focusing on psychological rehabilitation), will be followed by an exercise session on the one day and Electromyographic-feedback relaxation training will be followed by exercise every alternative day. Electromyographic-relaxation training, is a method that will teach you how to voluntarily control your own tension-anxiety levels through self-regulation of your psychological and physiological mechanisms.

RISKS: Due to the physical nature of the program, involving aerobic exercise components, certain potential risks may be experienced. These potential risks, refer specifically to the maximum graded exercise test, which may include: abnormal blood pressure, fainting, elevations in heart and respiratory rates as natural consequences of aerobic exercise. Resistance exercise may also cause some muscle soreness, however, these physical discomforts are normally temporary. Some subjects may however, report prolonged discomfort, in such an event, attempts will be made to provide for relief.

BENEFITS: Information regarding personal testing will be provided on your request. Such requests must be made officially by signing a release of information form provided on your request. Furthermore, it is important to note that your participation in this program will involve no expense to you concerning fees. The major benefit, through your participation, will be to help mental health therapists formulate a therapeutic intervention, relating adaptive behavior such as aerobic exercise, biological and psychosocial variables to the HIV \ (AIDS) disease.

CONFIDENTIALITY: Your consent to participate in this program, includes consent for the investigator and the assistants to review all your medical records as may be necessary for the purpose of this program. The investigator and the assistants will consider all your records confidential to the extent permitted by law. The results of the program may be published anonymously for scientific purposes, and your signature includes your agreement to this. Your records and results will not be identified or connected to you in any way, and no other publication without your expressed permission will be done. All results and identities will remain anonymous.

RIGHT TO WITHDRAW: Participation in the program is voluntary and you are free to withdraw your participation or consent and discontinue your participation at any time. You are further assured, that no current or future care will be influenced by withdrawing from the program. You should also however understand, that the Psychologist in charge can remove you from the study without your consent if he feels that it is in your best medical or psychological interest.

PARTICIPATION: In committing to this program you will be expected to attend all scheduled meetings, as these will have beneficial implications for your personal health and the development of this therapeutic intervention.

Signing this Consent form, I confirm having read it and agree to participate in the therapeutic intervention as specified. (Therapists copy)

_____

Please Print Name and Surname

_____

_____

Signature of Participant Date

_____

_____

Signature of Witness Date

PRINCIPAL INVESTIGATOR:

Prof. Edward Wolff, (Ph D)

Rand Afrikaans University

Tel: (011) 489-3129

Coordinating Therapists:

Lambros Messinis

Torsten R. Lamb

Clinic and Centre for Behavioral Medicine

Tel: (011) 837-0543\ 082 454 4730

Signing this Consent form. I confirm having read it and agree to participate in the therapeutic intervention as specified. (Participants copy)

_____

Please Print Name and Surname

_____

_____

Signature of Participant Date

_____

_____

Signature of Witness Date

PRINCIPAL INVESTIGATOR:

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Tel: (011) 837-0543\ 082 454 4730

APPENDIX B

PSYCHOMETRIC DEVICES USED

1) **PROFILE OF MOOD STATES (POMS)**

2) **THE BECK DEPRESSION INVENTORY (B D I)**

SCANTRON® FORM NO. T-101258-POMS 4887-C911-5 4

NAME _____ DATE _____

SEX: Male (M) Female (F)

IDENTIFICATION

Below is a list of words that describe feelings people have. Please read each one carefully. Then fill in ONE circle under the answer to the right which best describes HOW YOU HAVE BEEN FEELING DURING THE PAST WEEK INCLUDING TODAY.

The numbers refer to these phrases.

0 = Not at all
1 = A little
2 = Moderately
3 = Quite a bit
4 = Extremely

Col (C) O.P. (O)

	NOT AT ALL	A LITTLE	MODERATELY	QUITE A BIT	EXTREMELY
1. Friendly	0	1	2	3	4
2. Tense	0	1	2	3	4
3. Angry	0	1	2	3	4
4. Worn out	0	1	2	3	4
5. Unhappy	0	1	2	3	4
6. Clear-headed	0	1	2	3	4
7. Lively	0	1	2	3	4
8. Confused	0	1	2	3	4
9. Sorry for things done	0	1	2	3	4
10. Shaky	0	1	2	3	4
11. Listless	0	1	2	3	4
12. Peeved	0	1	2	3	4
13. Considerate	0	1	2	3	4
14. Sad	0	1	2	3	4
15. Active	0	1	2	3	4
16. On edge	0	1	2	3	4
17. Grouchy	0	1	2	3	4
18. Blue	0	1	2	3	4
19. Energetic	0	1	2	3	4
21. Hopeless	0	1	2	3	4
22. Relaxed	0	1	2	3	4
23. Unworthy	0	1	2	3	4
24. Spiteful	0	1	2	3	4
25. Sympathetic	0	1	2	3	4
26. Uneasy	0	1	2	3	4
27. Restless	0	1	2	3	4
28. Unable to concentrate	0	1	2	3	4
29. Fatigued	0	1	2	3	4
30. Helpful	0	1	2	3	4
31. Annoyed	0	1	2	3	4
32. Discouraged	0	1	2	3	4
33. Resentful	0	1	2	3	4
34. Nervous	0	1	2	3	4
35. Lonely	0	1	2	3	4
36. Miserable	0	1	2	3	4
37. Muddled	0	1	2	3	4
38. Cheerful	0	1	2	3	4
39. Bitter	0	1	2	3	4
40. Exhausted	0	1	2	3	4
41. Anxious	0	1	2	3	4
42. Ready to fight	0	1	2	3	4
43. Good natured	0	1	2	3	4
45. Desperate	0	1	2	3	4
46. Sluggish	0	1	2	3	4
47. Rebellious	0	1	2	3	4
48. Helpless	0	1	2	3	4
49. Weary	0	1	2	3	4
50. Bewildered	0	1	2	3	4
51. Alert	0	1	2	3	4
52. Deceived	0	1	2	3	4
53. Furious	0	1	2	3	4
54. Efficient	0	1	2	3	4
55. Trusting	0	1	2	3	4
56. Full of pep	0	1	2	3	4
57. Bad-tempered	0	1	2	3	4
58. Worthless	0	1	2	3	4
59. Forgetful	0	1	2	3	4
60. Carefree	0	1	2	3	4
61. Terrified	0	1	2	3	4
62. Guilty	0	1	2	3	4
63. Vigorous	0	1	2	3	4
64. Uncertain about things	0	1	2	3	4
65. Bushed	0	1	2	3	4

MAKE SURE YOU HAVE ANSWERED EVERY ITEM.

HOW ARE YOU FEELING?

Please read each group of statements carefully, then pick out the one statement in each group which best describes the way you have been feeling the **PAST WEEK**, INCLUDING TODAY. Circle the number beside the statement you picked. If several statements in the group seem to apply equally, circle each one. Be sure to read all the statements in each group before making your choice.

1. 0 I do not feel sad.
   1 I feel sad.
   2 I am sad all the time and I can't snap out of it.
   3 I am so sad or unhappy that I can't stand it.

2. 0 I am not particularly discouraged about the future.
   1 I feel discouraged about the future.
   2 I feel I have nothing to look forward to.
   3 I feel that the future is hopeless and things cannot improve.

3. 0 I do not feel like a failure.
   1 I feel I have failed more then the average person.
   2 As I look back on my life, all I can see is a lot of failures.
   3 I feel I am a complete failure as person.

4. 0 I get as much satisfaction out of things as I used to.
   1 I don't enjoy things the way I used to.
   2 I don't get real satisfaction out of anything anymore.
   3 I am dissatisfied or bored with everything.

5. 0 I don't feel particularly guilty.
   1 I feel guilty a good part of the time.
   2 I feel quite guilty most of the time.
   3 I fell guilty all the time.

6. 0 I don't feel I am being punished.
   1 I feel I may be punished.
   2 I expect to be punished.
   3 I feel I am being punished.

7. 0 I don't feel disappointed with myself.
   1 I am disappointed in myself.
   2 I am disgusted with myself.
   3 I hate myself.

(CIRCLE ONE)

8.
0 I don't feel I am any worse than anybody else.
1 I am critical of myself for my weaknesses or mistakes.
2 I blame myself all the time for my faults.
3 I blame myself for everything bad that happens.

9.
0 I don't have any thought of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10.
0 I don't cry anymore than usual.
1 I cry more now than I used to.
2 I cry all the time now.
3 I used to be able to cry, but now I can't cry, eventhough I want to.

11.
0 I am no more irritated now than I ever am.
1 I get annoyed or irritated more easily than I used to.
3 I feel irritated all the time now.
4 I don't get irritated at all by the things that used to irritate me.

12.
0 I have not lost interest in other people.
1 I am less interested in other people than I used to be.
2 I have lost most of my interest in other people.
3 I have lost all of my interest in other people.

13.
0 I make decisions about as well as I ever could.
1 I put off making decisions more than I used to.
2 I have greater difficulty in making decisions than before.
3 I can't make decisions at all anymore.

14.
0 I don't feel I look any worse than I used to.
1 I am worried that I am looking old or unattractive.
2 I feel that there are permanent changes in my appearance that make me look unattractive.
3 I believe that I look ugly.

15.
0 I can work about as well as before.
1 It takes an extra effort to get started at doing something.
2 I have to push myself very hard to do anything.
3 I can't do any work at all.

(CIRCLE ONE)

16. 0 I can sleep as well as usual.
1 I don't sleep as well as I used to.
2 I wake up 2-3 hours earlier than usual and find it hard to get back to sleep.
3 I wake up several hours earlier than I used to and cannot get back to sleep.

17. 0 I don't get more tired than usual.
1 I get tired more easily than I used to.
2 I get tired from doing almost anything.
3 I am too tired to do anything.

18. 0 My appetite is no worse than usual.
1 My appetite is not as good as it used to be.
2 My appetite is much worse now.
3 I have no appetite at all now.

19. 0 I haven't lost much weight, if any lately.
1 I have lost more than five pounds.
2 I have lost more than ten pounds.
3 I have lost more than fifteen pounds.

19. (a) I am purposely trying to lose weight by eating less.

Yes_____ No_____

20. 0 I am no more worried about my health than usual.
1 I am worried about physical problems such as aches and pains, or upset stomach or constipation.
2 I am very worried about physical problems and it's hard to think about anything else.
3 I am so worried about physical problems that I cannot think about anything else.

21. 0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.