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Stress and AIDS among intravenous drug users: Psychosocial influences on risk behavior and immunity

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STRESS AND AIDS AMONG INTRAVENOUS DRUG USERS: PSYCHOSOCIAL INFLUENCES ON RISK BEHAVIOR AND IMMUNITY

by

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Abstract

STRESS AND AIDS: PSYCHOSOCIAL INFLUENCES ON RISK BEHAVIOR AND IMMUNITY

by

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This study considers the relationship of psychosocial factors with behavioral and biological processes involved in Acquired Immune Deficiency Syndrome (AIDS) among intravenous drug users (IVDU). It concerns links between stress, distress, and high risk behavior as well as the association of stress and distress with symptoms and change in immune cell levels.

Data are from a larger ongoing study of risk factors for AIDS (NIDA grant 03594; Don C. Des Jarlais, P.I.) The sample consists of 160 patients in methadone treatment interviewed twice, about nine months

apart. Forty nine percent of the respondents were seropositive for the HIV virus at intake.

Multiple regression analysis was used with each of the risk behaviors (frequency of injecting drugs, unsafe sex) and with AIDS-related symptoms and change in immune cell count as dependent measures and stress and distress as independent measures.

Stress at time 1 was significantly associated with frequency of injecting drugs at time 1 ($p<.000$) and frequency of injecting cocaine at time 1 ($p<.0002$). Stress, race, cocaine injection, and age were significantly associated with unsafe sex at time 1 and stress with unsafe sex at time 2. Those who continued to inject drugs at time 2 scored significantly higher in distress. Distress was significantly negatively correlated with drug injection suggesting that injection acts as a short term palliative for distress. Stress at time 2 was not associated with injecting drugs at time 2. By time 2, frequency of injecting drugs had declined significantly ($t = 4.54$ $p<.000$ for any drugs; $t=2.01$ $p<.04$ for cocaine).

Distress, but not stress, was significantly associated with symptoms at both time 1 and time 2 for the group as a whole and with change in CD8 cell count at time 2 in both seropositive and seronegative subjects when these groups were analyzed separately. There were opposite signs for correlations of stress and distress with some immune cell change counts for seronegative and seropositive individuals, indicating a moderator effect for serostatus on correlations of stress and distress with immune cell change.

This study suggests the importance of psychosocial factors in risk behavior and symptom development and raises the question of whether serostatus moderates the effects of stress and distress on immune cell count. AIDS among IVDUs in New York City is growing at a rate triple that of gay men. Among gay men, their own efforts at behavior change has brought the stabilization in the rate of AIDS development. Intervention efforts aimed at IVDUs should be undertaken.

For
Robert, Mark, Richard,
Carolyn, Claire and John

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This study is concerned with intravenous drug users and their rising rate of infection with human immunodeficiency virus (HIV). Little attention has been paid to the impact of stress on this group. Stress, however, deserves attention. It may be involved in the etiology of a drug problem, and it may also be linked to behaviors which are associated with the transmission of the HIV virus, as well as with symptom development once HIV is established.

Until recently, gay men constituted the population where HIV infection was increasing. That is no longer true. Due largely to their own efforts at behavior change, HIV rates have stabilized and begun to decline among that group. Now HIV infection is increasing among intravenous drug users and their sexual partners. Between 1985 and 1989, AIDS among intravenous drug users grew 1.5% faster than it did among gay men. In New York City, it grew at a rate triple that of gay men (Garret, 1990). Drug use is spreading the AIDS epidemic heterosexually and is putting women and neonates increasingly at risk.

It is this particular risk group, intravenous drug users, that is the subject of this research. Compared to studies of other groups at increased risk for AIDS, there has been little research on HIV infection among intravenous

drug users (Des Jarlais, Friedman, and Stoneburner, 1988). In New York City, the locale of this study, intravenous drug users are the apparent source of the virus in 87% of the cases in which heterosexual activity is believed to be the mode of transmission, and in 80% of the cases of maternally transmitted AIDS (Friedman et al, 1987). Furthermore, it is in the New York metropolitan area that the vast majority of AIDS cases among IVDUs in the United States are concentrated. New York City has an AIDS caseload of approximately 7,000 attributable to intravenous drug use, comparable to the total number of AIDS cases in San Francisco (New York City Department of Health, April, 1988; Friedman et al, 1989).

The research, presented here, considers both behavioral and biological processes in a group of intravenous drug users who are at increased risk for AIDS. Examined here are links between stress, as measured by objective events which would reasonably be considered to be stressful to the majority of people, distress, as measured by subjective reports of mood, and high risk behavior; as well as associations between stress and or distress, the immune system and symptom formation.

Stress and Drug User's Environment

It should be clarified at the outset that stress refers to events and chronic strains in the lives of this population, while distress refers to the individual reactions to these stressors, as measured by their reports of depressive mood and anxiety. Stress and distress are particularly appropriate to look at because they form an integral part of the psychosocial framework that defines the lives of intravenous drug users. The sample for this study, which will be described more fully below, was drawn from a segment of the population of drug users in New York City which is economically disadvantaged and socially stigmatized. As Mechanic (1986) has indicated, stressful life events occur more commonly among disadvantaged populations. Moreover such individuals have fewer resources to deal with them. Social class is related to different degrees of instrumental resources and social support (Kessler, 1979). In addition to this, certain groups have more stress as a function of how the rest of the community views them. Herek (1989) has pointed out that negative reactions to AIDS are reactions to gay men, drug users, racial minorities, or outsiders in general. Glaser and Kiecolt-Glaser have also commented on this.

The high-risk populations for acquired immune deficiency syndrome (AIDS) and AIDS-related complex (ARC), such as homosexual men, may be a more psychologically

stressed group because of societal and sociological pressures. Furthermore, this population which is aware of the AIDS association with homosexuality, is under additional psychological stress because of the knowledge of the association of this devastating illness with their sexual practices (Glaser and Kiecolt-Glaser, 1988).

Clearly, this applies equally to the population of intravenous drug users in this study. In fact, such stress may well be greater for intravenous drug users since they have not formed the support network which homosexual men have (Friedman, Sufian et al, 1989; Friedman, de Jong, and Des Jarlais, 1988; Friedman, Des Jarlais, Sotheran et al, 1987). They must deal with the sense of generalized mistrust within their own subculture, described by Des Jarlais and his colleagues (1986) as well as societal stigmatization.

There is evidence that drugs can be a symptom of urban poverty and oppression, major societal sources of stress (Pearlin, 1989; New York City Commission on Human Rights, 1987; Blumberg, 1973). For example, both tuberculosis and intravenous drug use in New York City are found primarily among lower-class minority groups (New York City Department of Health Bureau of Tuberculosis 1986 Annual Report; Stoneburner, Des Jarlais et al, 1988). The particular stressors dealt with in this study, such as homelessness and being arrested, are far more common occurrences in the lives of these individuals than they are in the lives of middle

class people who were the population used to develop the more commonly used stressor measures.

Drug Use as Maladaptive Coping

The study described here adopts an adaptive, rather than an exposure orientation to drug use. In terms of social policy, the exposure orientation indicates a primary focus on drug prohibition because the drug itself is seen as the cause of addiction (Alexander and Hadaway, 1982). This view ultimately implies reliance on police powers. The adaptive orientation is the view that opiate addiction is an attempt to adapt to severe distress through habitual use of opiate drugs. In terms of social policy, it implies an attempt to identify the social problems that generate the distress and take steps to ameliorate these problems.

In terms of the need to escape pain or the need for happiness or feeling good in a situation of individual and communal angst, drugs have long been known to serve such a purpose. In 1930, writing in Civilization and Its Discontents, Freud observed:

> But the most interesting methods of averting suffering are those which seek to influence our own organism. In the last analysis, all suffering is nothing else than sensation; it only exists in so far as we feel it, and we only feel it in consequence of certain ways in which our organism is regulated. The crudest, but also the most

> effective among these methods is the chemical one - intoxication.
>
> The service rendered by intoxicating media in the struggle for happiness and in keeping misery at a distance is so highly prized as a benefit that individuals and peoples alike have given them an established place in the economics of libido. We owe to such media not merely the immediate yield of pleasure, but also a greatly desired degree of independence from the external world. For one knows, with the help of the "drowner of cares" one can at any time withdraw from the pressure of reality and find refuge in a world of one's own with better conditions of sensibility (Sigmund Freud, 1930).

Of course not everyone living in an oppressive social environment uses drugs. Many individuals develop more adaptive coping mechanisms. Research indicates, for example, that young people who have an adult role model and who can project themselves in their imagination into a better place in the future are much less at risk for substance abuse than are their siblings who lack these assets (Chein, unpublished manuscript). Family values concerning the traditional society, the underground economy and whether the milieu implicitly condones participation in a drug subculture are also important factors (Williams, 1989). That some do survive adverse social circumstances is encouraging, and much research has examined how this comes about (see Anthony and Cohler, 1987 for a review).

The research proposed here, however, is concerned with those who have not - those who have chosen an adaptive

mechanism which could have been predicted to fail. Its basic aim is to ask whether, within this group, whose members all share the constraints of their societal position, those who are higher in stress and distress exhibit more behavior, putting them at risk for AIDS, more reports of AIDS-related symptoms, and greater immune changes. If we can identify an association between these outcomes and psychosocial factors, it may be possible to design interventions which will ameliorate the impact of these psychosocial factors. In addition, such findings may form the basis for the implementation of broad changes in social policy.

STRESS, DISTRESS AND RISK BEHAVIOR

The urgency connected with understanding how HIV is transmitted caused researchers to focus on simply specifying the behaviors involved in transmission. Initially, there was no time to speculate about why people engage in those behaviors. At this time, a number of factors have been clearly established as being associated with HIV transmission among intravenous drug users. They are discussed in the following section on page 9. Now it is appropriate to look for psychosocial factors which may underlie those behaviors.

Stress and emotional distress are easily pointed to as possible correlates of behaviors, which increase the risk of HIV transmission among intravenous drug users, such as injecting frequently, sharing needles, and unsafe sex. The social psychological framework for drug use which was discussed above suggests that drug use is frequently a maladaptive coping mechanism used to mitigate the effect of severe stressors present in the drug user's environment. Whereas effective coping can be expected to reduce the effects of these stressors, maladaptive coping can be expected to result in increased, rather than decreased, distress. If one function of drug use is to deal with stress in the environment, it is reasonable to conclude that, as stress and distress increase, drug injection frequency will rise. Since New York is one of eleven states where it is illegal to possess one's own needle, it is also reasonable to believe that sharing needles may also increase along with increased injecting. Coates and his colleagues (1987) found that stress management significantly decreased unsafe sex among a group of seropositive gay men, so it is possible that stress may play a role here as well.

Several different literatures have been relied upon in doing this research. For the sake of clarity, it is useful to have a map of the areas which will be covered. First, how the HIV virus is transmitted will be discussed. Both

the risk associated with injection behavior, and the more widely known route of sexual transmission of the virus will be presented. The relative importance of these modes of transmission, as it relates to this particular population, will be specified. Then we will turn from behavioral to biomedical concerns. First we will review what has been learned about the relationship between stress and illness. Then we will look at a new discipline, psychoneuroimmunology, which concerns how stress and distress affect the immune system, to see what it has to tell us about this relationship. AIDS is, after all, a devastating disease of the immune system and it has stimulated considerable research in this area. Finally, the literature on social support will be discussed since individual differences in this stress moderator may affect stress effects in this sample.

Behaviors Associated with HIV Transmission

Frequency of Injection

Frequency of drug injection has been linked to seropositivity for HIV in several risk behavior studies in the New York City area (Marmor, Des Jarlais et al, 1987; Weiss et al, 1985; Schoenbaum et al, 1986). Clients in methadone maintenance treatment, such as the people in this

study, ideally would not inject any drugs. In actuality, only 35% of the subjects in this research were not injecting any drugs at the time of the initial interview. Methadone blocks opiate withdrawal symptoms and is associated with marked reduction in heroin use. Abdul-Quader and his colleagues (1987), in a sample of 195 intravenous drug users enrolled in a New York City methadone maintenance treatment program, found a negative correlation of -.325 (p=.001) between drug injection and time in methadone maintenance treatment. One interest of this study is to see whether there is an association between stress and distress and continued injection. In a study of a population similar to that used in the present study (IV drug users in methadone maintenance treatment), Batki and his colleagues (1989) found suicidal ideation, a reasonable indicator of distress, a significant predictor of continued injection behavior while in treatment. Those individuals reporting suicidal thoughts or attempts had three times as much heroin use and sixteen times as much cocaine use at twelve months after entering treatment as those not making such reports.

In addition to the risk of HIV transmission from frequent injection, there is evidence that drugs of abuse affect CD4 cell loss once HIV infection is established. Recently Des Jarlais and his colleagues found significant differences in CD4 cell loss in a sample of 69 seropositive

drug users who injected drugs frequently. He did not find significant CD4 cell decline in those seropositive drug users who were not injecting frequently (Des Jarlais et al, 1988). The clinical course of HIV infection is mainly determined by the number of CD4 lymphocytes in the blood (McCutchan, 1990).

Cocaine Injection

Methadone has no specific pharmacological effect on cocaine addiction. Chaisson and his colleagues (1989), in a study of drug users in community based treatment programs in San Francisco, found that cocaine use was common during methadone treatment. They found the same marked reduction in the frequency of heroin use as Abdul-Quader did in New York. However a minority failed to decrease cocaine injection; 26% began and 6% increased the frequency of cocaine injection after beginning treatment.

Cocaine injection is important for several reasons. Its short half life encourages more frequent needle use than heroin does. Chaisson and his colleagues (1987; 1988; 1989) found intravenous cocaine use significantly increased the risk of HIV infection. In a prospective cohort study of intravenous drug users with known HIV status, Des Jarlais and his colleagues (1988) found seroconverters significantly

more frequent users of cocaine than non-converters ($p<.02$). The converters reported a mean of 65 injections per month in the period preceding the interview; the non-converters reported a mean of only 13 per month. This effect was specific to cocaine injection. Total number of injections of all drugs and injections of heroin alone were not significantly related to conversion in that particular study. Other studies (Marmor et al, 1984; Schoenbaum et al, 1986), as noted above, have implicated injection frequency of any drug in seroconversion.

Unsafe Sex

Most of the research on risk factors for AIDS has been done using samples of gay men where sexual transmission is clearly the most important factor (Schecter et al, 1987; Joseph et al, 1987). Coates and his colleagues tested the hypothesis that stress management training for HIV antibody positive men would decrease high risk sexual behavior. At baseline, there was no difference, in Coates study, between treatment subjects and controls. When compared to controls at follow-up, treatment subjects reported significantly lower rates of sexual behavior capable of transmitting HIV (Coates et al, 1987). Joseph, who has also done extensive research in this area, expressed concern that "psychological and social distress may ultimately reduce adherence to

behavioral risk reduction guidelines or disrupt maintenance of established, positive behaviors (Joseph et al, 1987).

It does not appear that sexual transmission of the HIV virus approaches the sharing of drug injection equipment as a risk factor among intravenous drug users (Des Jarlais, Wish and Friedman, 1987). Nevertheless, unsafe sex within this population is still a cause for concern. In New York City, 87% of the cases of heterosexual transmission have occurred from an intravenous drug user to a sexual partner who does not inject drugs (Des Jarlais et al, 1987). Among intravenous drug users, the great majority, approximately 75%, have their primary sexual relationship with women who do not inject drugs (Des Jarlais et al, 1984).

If the proposed association between stress and cocaine use is established, then the fact that cocaine lowers inhibition and sex is frequently exchanged for cocaine (Williams, 1989) may establish an association between stress and unsafe sex. Drug and alcohol use has been linked to unsafe sex among gay men (Stall et al, 1986).

Stress and Illness

Turning now from the discussion of behavioral effects of stress to biomedical concerns, we find a rich literature

on the association between stress and illness. A long line of investigation has implicated stress as one factor in illness development (Kobasa, 1982; 1979; Keller et al, 1981;Holmes and Masuda, 1974; Solomon et al, 1974;). Early attempts at assessing stress were based on a model which considered homeostasis as the desirable condition. Change, which required adaptation, was thought to be what caused stress. Life events scales, such as the Social Readjustment Rating Scale (Holmes and Rahe, 1967) were utilized which focused on the amount of life events which occurred during the prior year. Although low, but consistent, correlations were found between life events and illness (Rabkin and Streuning, 1976), a number of researchers (Kobasa, 1984; Pearlin and Lieberman, 1979) questioned the basic model. Was a happy healthy life "a placid existence of undisturbed routines"? (Mirowsky and Ross, 1989). As research evolved, it became apparent that there were aspects of change which made events more or less stressful. Desirable change was not as stressful as undesirable change (Avison and Turner, 1988; Thoits, 1981). Pearlin identified additional aspects of life change which made it more or less stressful. He pointed out that events which occurred "on time" could be preceded by anticipatory coping, which might buffer the effect of the event. Certain events are "scheduled", marriage, a child leaving home, widowhood, retirement. Some events are in accord with

societal norms, such as getting married and some events are not normative, such as getting divorced. Certain events occur by personal choice, such as moving to another city. Pearlin (1989) suggests that events which are undesired, unscheduled, non-normative, and uncontrolled entail greater stress.

Some of the events included in life events measures, such as change in eating and sleeping habits are symptoms rather than events (Dohrenwend and Dohrenwend, 1981). Some of these symptoms are operationally confounded with the dependent measure in a number of studies (Thoits, 1981). For example, change in sleeping habits may appear on a stress measure where the dependent measure is depression. Since change in sleeping habits is frequently a symptom of depression, a spurious association may be reported. This was particularly important to bear in mind in this study where knowledge of one's serostatus may be a source of chronic stress, but serostatus is also associated with the dependent measures of changes in blood cell counts, symptom development, and death from AIDS. It will be shown below that there are other ways to assess that particular source of stress, thus avoiding this confound of the dependent and independent variables.

In examining life events, greater emphasis came to be placed on context, which has been defined as

> the embeddedness of life events within temporal, psychological, and social situations that determine both the meaning of the events and the individual and group capacities for dealing with them (Eckenrode and Gore, 1983).

The context within which the people in this study live adds a deeper dimension to some of the events, such as losing a job. Their education, skills, and the current state of the job market in New York City suggest that the problem will persist for some time. Life events and chronic strain are both sources of stress which may have a synergistic effect (Avison and Turner, 1988; Pearlin, 1983; Pearlin, Lieberman, Menaghan, and Mullan, 1981). Eckenrode and his colleagues argue that ongoing life conditions, such as impoverished economic standing, set the stage for the occurrence of discrete stressful events (Eckenrode and Gore, 1983).

Taking this into consideration, current stress research is now more likely to consider both the occurrence of discrete events and the presence of relatively continuous problems (Pearlin, Menaghan, Lieberman and Mullan, 1981). Because events are embedded in a context they frequently result in other sources of stress. Loss of a job may result in economic hardship and marital discord. Kessler (1984) has suggested that chronic stressors, rather than

change, may constitute the specific components of life events that make them problematic. This knowledge was incorporated into research which began to investigate both acute events and chronic strains as stressors. Eckenrode (1984), for example, looked at both acute events and chronic strains to determine their association with mood. Fleming, Baum, and Singer commended this assessment of multiple sources of stress which "suggests once again that the stress process is dynamic and extremely complex" (Fleming et al, 1984). Pearlin also advised that:

> The conceptualization and measurement of stress should move away from their focus on particular events or chronic strains and should seek instead to observe and assess over time constellations of stressors made up of both events and strains (Pearlin, 1989).

Fleming and his colleagues noted that while acute events may be more intense while they last, chronic stressors may ultimately be more damaging. They based this conclusion on their research on the residents of Three Mile Island area where the stress effects observed were due primarily to chronic uncertainty in the area rather than to the nuclear accident that occurred there (Baum, Fleming and Singer, 1982). This is reminiscent of the chronic uncertainty which pervades the lives of the individuals in this study whose apprehension revolves around a lethal virus rather than nuclear contamination.

Stress and the Immune System

This section, concerning symptom formation, is based on a recent development in the search for relationships between the etiology and course of disease and stress that has focused on the role of the immune system. The new discipline, psychoneuroimmunology, deals with the complex bidirectional interactions of psychological factors, the central nervous system, and the immune system (Solomon and Temoshok, 1987). Although the connection between the central nervous system and the immune system was implied in the work of Hans Selye as early as 1936, most research in immunology progressed until recently as though these were autonomous systems. This may in part be due to the fact that immune functions could be demonstrated in vitro without the contribution of the central nervous system.

Recent research, while recognizing the autonomous capacity of the immune system, has indicated that the central nervous system may play a role in regulating immune function. Direct anatomical links between the nervous system and the immune system have recently been discovered. Autonomic innervation of the thymus and spleen have been reported (Felton et al, 1987; Williams et al, 1981). Numerous connections between the central nervous system and the immune system, such as nerve endings in the thymus,

lymph nodes, spleen, and bone marrow, suggest the existence of a complex, communicative, and interactive system between the brain and the immune system (Pelletier and Herzing, 1988). Cells of the immune system can respond to chemical signals from the central nervous system via neuroendocrines, neuropeptides, neurohormones, and neurotransmitters including epinephrine, norepinephrine, histamine, and dopamine (Stein, 1989; Pelletier and Herzing, 1988). It has been demonstrated that there are receptors for neurotransmitters on certain immune system cells (Stein, 1989; Hohlfield et al, 1984; Williams et al, 1976). Lymphocytes have binding sites for a variety of hormones (Dunn, 1989). There is also evidence for links in the reverse direction. Immune cells can produce polypeptides which communicate with other immune cells and also other organs including the brain (Dunn, 1989). These peptides, which include interferons and interleukins, are hormones produced by cells of the immune system (Smith, 1990; Dunn, 1989). Given this information, a more integrated approach is presently used in current research.

There have been a number of studies of the effects of stress on various components of the immune system. Most of these studies have examined the responses of mononuclear cells isolated from peripheral blood.

Kiecolt-Glaser and her colleagues compared cellular immune responses in 75 first-year medical students during final examinations with responses considerably before and after examinations. Cellular immunity was examined in terms of cytotoxic activity of natural killer (NK) cells. Baseline NK activity, determined from a blood sample drawn one month prior to final exams and one month after the last major exam, was compared with activity during final exam week. Examination levels were significantly lower ($p < .003$) than baseline for the group.

The significant drop in natural killer cell activity during examinations was replicated in two additional studies of medical students (Glaser et al, 1986; Kiecolt-Glaser et al, 1986). In the latter study (Kiecolt-Glaser et al, 1986), the production of interferon by stimulated lymphocytes fell from a mean of 2000 U/mL at baseline to 80 U/mL during final examinations in blood samples from forty second-year medical students. Interferon augments natural killer cell activity (Gorden, 1988). In a similar study, Dorian and colleagues found examination stress among psychiatry residents to be correlated with a decrease in lymphocyte proliferation as compared with matched control groups (Dorian et al, 1982)

In another study of examination stress, Jemmott and his colleagues examined the effect of examination periods on the level of immunoglobulin A (IgA) in forty-seven first-year dental students (Jemmott et al, 1983). IgA concentrates in body fluids like tears, saliva, and secretions of the respiratory and gastrointestinal tracts, and functions to protect these areas from invasion by pathogens. This type of IgA is thought to act as a barrier, rather than being involved in direct killing (Calabrese et al, 1987). Measurements of IgA in the saliva of the dental students were taken at five times during the year. All samples were collected at the same time of day to avoid possible effects of diurnal variation. The points considered "low stress" were in September (at the beginning of the first semester) and July (the beginning of the second semester) before course work began. The points considered "high stress" were November, April, and June (during examinations). Student ratings of the psychological climate of these time periods coincided with the experimenter's evaluation. Jemmott and his colleagues found significantly lower levels of IgA during "high stress" periods as compared to "low stress" periods. A follow-up study to check on possible seasonal variations in IgA is discussed below in the section on social support as a stress moderator.

Locke and his colleagues (1984) did a large retrospective study of healthy volunteers (114 college students) to test for associations among objective stressors, psychiatric symptoms, and NK cytotoxic activity. Subjects were evaluated on two separate occasions two weeks apart. The students self-rated life stressors over the past month, and over the past year excluding the past month. They rated symptoms according to the Hopkins Symptom Check List. At the second meeting they again reported symptoms and gave blood for the measure of NK activity. NK cytotoxic activity showed no correlation with objective stress; NK activity did show significant correlations ($p < .01$) with symptom distress at the first meeting. When divided into high and low distress groups (above and below the median initial symptoms), mean NK activities were quite different ($p < .001$). The high and low symptom groups were further subdivided according to yearly objective stress. The high stress/low symptom group ("good copers") had the highest NK activity and the high stress/high symptom group ("poor copers") had the lowest activity (difference significant at $p < .0005$). This research is particularly pertinent to the present research because it suggests that objective stress alone does not predict immunosuppression, but that long term strain associated with psychic distress appears to be a factor in the regulation of immune function.

Emotional Distress

Once individuals convert from seronegative for HIV to seropositive, there is wide variation in the amount of time it takes for symptoms to develop (Liu, Dallow and Rutherford, 1988). There is reason to believe that emotional distress will affect symptom development in intravenous drug users. In a sample of 227 HIV infected gay men examined semi-annually for three years, higher levels of depression, anxiety, and global psychological distress were consistently and significantly associated with subsequent symptom development (Joseph et al, 1988). This relationship was not observed for coping or personality measures in this study. Joseph and her colleagues concluded that psychological distress may adversely impact health of HIV-infected individuals perhaps by influencing immune function.

There has been considerable research on how distress (for example, depression, and loneliness) affect the immune system (Kiecolt-Glaser et al, 1984; Kiecolt-Glaser et al , 1986). Research by Linn (1984) used the Hopkins Symptom Checklist to assess severity of depressive symptoms while studying various measures of humoral and cell-mediated immunity. Lymphocyte responses to PHA were significantly reduced only in bereaved subjects with high scores on the

depression subscale of the rating instrument (Linn et al, 1984). Immunologic function was also shown to be reduced in this depressed subgroup of bereaved individuals, when the assessment was based on the responses of their lymphocytes to incubation with lymphocytes taken from another individual. This abnormality suggests an alteration in one or more components of cell-mediated immunity.

Kiecolt-Glaser and her colleagues examined effects of both loneliness and stressful life events on various immune system measures. They assessed lymphocyte response to PHA and pokeweed mitogen. They found that a subgroup of subjects with high scores on the UCLA Loneliness Scale showed abnormally high cortisol, reduced lymphocyte response to PHA, and decreased natural killer cell activity (Kiecolt-Glaser et al, 1984). Deviations in natural killer cell activity and lymphocyte responses to PHA suggested that cell-mediated immunity was impaired. In order to evaluate the relative contributions of loneliness and distress to immunocompetency, multiple regression analyses were performed. For all three NK effector to target cell ratios, and for all but two of the PHA dilutions, loneliness emerged as the best predictor of immunocompetence.

In 1977, Bartrop reported a relationship between psychological state and immunologic function. Bartrop

isolated lymphocytes from the blood of 26 men and women whose spouses were seriously ill. He cultured the samples with substances known to stimulate lymphocyte proliferation (mitogens). At six weeks, but not at two weeks, of bereavement T cell proliferation was significantly lower in bereaved subjects in response to both mitogens (Bartrop et al, 1977). Bartrop and his colleagues also measured a variety of other basal indicators of immunologic function in their bereaved subjects, including T and B cell percentages and serum immunoglobulin concentrations. No differences were found in absolute T and B cell numbers or antibody levels.

In another study, Schleifer and his colleagues (1983) prospectively assessed white blood cell count, T and B lymphocyte subpopulations, and mitogen stimulation of lymphocytes in cultures in fifteen men before and serially after the deaths of their wives from metastatic breast cancer. Although T and B cell counts after bereavement were unchanged, Schleifer and his colleagues replicated Bartrop's findings of blunted mitogen stimulation of lymphocytes in the bereaved population (Shleifer et al, 1983). A highly significant reduction in lymphocyte proliferation was seen at 1-2 months of bereavement ($P < .03$ for each of three mitogens).

Depression has been reported to be associated with reduced immunocompetence in psychiatric populations. Depressed inpatients have a poorer response to mitogens than nondepressed controls (Kronful and House, 1984; Stein, Keller and Schleifer, 1985). Depressed patients have had lower percentages of T-helper lymphocytes than nondepressed controls (Stein et al, 1985). In a subsequent study of 91 depressed patients and controls, Schleifer, Stein and their colleagues (1989) found no significant differences in mitogen-induced lymphocyte proliferation, lymphocyte subsets, or natural killer cell activity. There were significant age-related differences between the depressed patients and controls in mitogen responses and number of CD4 lymphocytes. Controls had age-related increases in CD4 cells and mitogen response, while depressed patients did not. They concluded that altered immune function does not occur in all depressed patients, but in a subset of patients (Stein et al, 1988; Schleifer et al, 1989; Stein, 1989).

It has been proposed recently that distress related immunosuppression may have its most important consequences in individuals with preexisting decrements in immune function (Kiecolt-Glaser and Glaser, 1986). Therefore the possibility that stress and distress might contribute to the development of symptoms in immunocompromised seropositive IV drug users is an important area of research. "Even if

sexual activity and drug use are primary in exposing persons to AIDS, it is important to identify the variety of factors that may compromise immune function and determine host response" (Coates et al, 1987).

Stress Moderators

The relationship between stress and illness is a complex issue, since there are buffers which moderate the effects of stress, and thus affect outcome. Frequently examined buffers include coping strategies (McCrae, 1984; Stone and Neale, 1984; Alwin et al, 1980), personality factors (Kobasa, S.C., 1985 (b); Kobasa, S.C., 1982; Kobasa and Pucetti, 1983; Kobasa, Maddi, and Kahn, 1982; Kobasa, 1979), and social support (Cohen and Syme, 1986; Cohen and Wills, 1985). In this study we will examine two factors which may moderate the effects of stress or distress on this sample. These moderators are social support and race.

To date there has been little research on whether race moderates the effect of stress and distress. Dohrenwend and Dohrenwend (1967) concluded that race is not an important predictor of mental illness when age, sex, and socioeconomic status are controlled. Kessler and his colleagues (1986), however, found that the widely held belief that race is not

an independent determinant of psychological distress is due to omitting from equations a multiplicative interaction between race and social class. In a meta analysis of eight previous studies (n=22,000) Kessler found a significant effect for race independent of social class. He suggests that the joint effects of poverty and discrimination might have a synergistic effect, or certain resources for coping with stress might be less available to lower-class blacks than to lower-class whites (Kessler and Neighbors, 1986). Here race will be examined as a moderator of stress or distress in those instances where these variables are significantly associated with risk behavior or health change.

Social support is a more frequently researched moderator of stress effects. The term refers to the mechanisms by which interpersonal relationships protect people from adverse effects of stress (Kessler et al, 1984). It has been suggested that social support operates by influencing one's appraisal of the stressfulness of a situation (Cohen and McKay, 1984; House, 1981). Others have examined its effect on self-esteem and improved coping mechanisms (Kessler et al, 1984).

There is evidence from research on both animals and humans that social support offers protection from the

effects of stress on the immune system. Research has generally indicated that cell-mediated immunity is altered among mice, rats, and monkeys exposed to a variety of experimental stressors (Keller et al, 1981; Laudenslager et al, 1982; Monjan and Collector, 1977; Joasoo et al 1976, Justice et al, 1985, Calabrese et al, 1987). Coe and his colleagues (1987) investigated the capacity of infant squirrel monkeys to mount an antibody response to viral challenge after removal from their mothers in several social and physical environments. Control and separated infants were injected with a benign virus, the bacteriophage x 174, and levels of neutralizing antibody were assessed for three weeks. Separated infants, alone in an unfamiliar environment, showed a significant reduction in antibody levels as compared to control infants. Allowing infants to remain in the home environment, either alone or with peers, prevented this inhibition of antibody responses from occurring. Similarly, providing familiar peers in the novel environment facilitated the normal expression of antibody responses. These results suggest that the trauma of maternal separation is significantly reduced when infants are familiar with the separation environment or familiar social companions are available.

In a related study, Reite and his colleagues measured lymphocyte response in a pair of pigtailed monkey infants

that had been raised together as peers since early infancy. At the age of 27 weeks, and following 3 baseline weekly blood samples, the infants were separated from each other for an 11 day period, and then reunited. A depression of lymphocyte stimulation by both PHA and Con A was noted during the latter part of separation and early reunion in both infants. The data support the notion that the disruption of an attachment bond produced by peer separation may impair these measures of cellular immune function, and may be related to the increase in morbidity and mortality seen after bereavement (Reite et al, 1981).

In a follow-up study to the one discussed above on examination stress and IgA levels (Jemmott et al, 1983), Jemmott and his colleagues checked on possible effects of seasonal variation of IgA levels. All measures of IgA and social support were taken within the span of one month, five days before examinations, the day of the third and most difficult examination, and during the first week of spring semester. In this study, need for, amount of, and self-perceived adequacy of social support were measured. Again, Jemmott found significant differences in levels of IgA between the "high stress" and "low stress" points. He also found a main effect for social support, that is, social support was significantly related to IgA levels in both the" high stress" and "low stress" conditions. Higher adequacy

of social support was related to higher levels of IgA in both conditions (Jemmott and Magloire, 1988).

In research on the effects of loneliness and examination stress on immune system components of medical students, only loneliness reached significance (Kiecolt-Glaser et al, 1985). Changes in antibody levels of three types of herpes virus (Epstein-Barr virus [EBV],herpes simplex type I [HSV-I],and cytomegalovirus [CMV] among medical students were examined. Epstein-Barr virus is the etiological agent for infectious mononucleosis. HSV-I can produce cold sores, encephalitis, and generalized infection. CMV infection can result in mononucleosis. Blood was drawn one month before final examinations, on the first day of final examinations, and on the first day of return from summer vacation. Students were divided, by a median split, into high and low scorers on the UCLA Loneliness Scale. Students were screened for health problems in the two weeks preceding drawing blood for examination. Significant effects were found for loneliness in the antibody titers to these viruses with the "high loneliness" subjects having higher EA and VCA titers. The main effect for loneliness was nonsignificant for the HSV-I and CMV titers.

In the research discussed above on the effect on NK cells in 75 first year medical students, after the

determination of the effect on NK cells, the data was stratified according to subjective criteria of stress. Students scoring highest on self- rated scales of loneliness (UCLA Loneliness Scale) and stressful life events (Social Readjustment Rating Scale) were found to have lowest baseline and exam-week cytotoxic activity (Kiecolt-Glaser et al, 1984).

Kiecolt-Glaser and her colleagues (1984) also examined 33 newly admitted nonpsychotic psychiatric inpatients for associations among loneliness, stressful life events, urinary cortisol levels, NK cell activity, and lymphocyte response to mitogens. The "high loneliness subjects" (UCLA Loneliness Scale) had significantly lower levels of natural killer cell activity ($p < .05$). Lymphocyte stimulation at low levels of PHA was depressed ($p < .03$) and urinary cortisol was elevated ($p < .05$) in this group. The authors note that cellular immunocompetence in two very different populations, medical students and inpatient psychiatric patients, shows consistent inverse correlations with loneliness.

In summary, this study is concerned with a group which has been neglected in research on AIDS. From 1985 to 1989, however, AIDS among intravenous drug users grew 1.5 times faster than among gay men. While scientists work to

understand the complexities of this disease, it is important that social scientists seek to understand the behavioral and psychosocial factors which are associated with HIV transmission and which may hasten disease progression in those persons already infected. Moreover, it is useful to highlight the social conditions which foster drug abuse. Robert Gallo and Luc Montagnier (1988) have indicated that "efforts to control AIDS must be aimed in part at eradicating the conditions that give rise to drug addiction".

Although the focus is on individual differences among the people in this group, it is done within a framework which sees drug use as a form of maladaptive coping in conditions of severe deprivation. If psychosocial factors, which are associated with injection behavior and symptom development, can be identified, it may suggest that the drug problem is more related to social conditions which we can control than to the behavior of drug dealers which we have had little success in controlling.

HYPOTHESES

1. Stress and emotional distress, taken both individually and additively, will be associated with injecting drugs more frequently. This first hypothesis follows from the conceptual framework that using drugs is, at least in part, a way of coping with stress in the drug user's environment. It is expected that these psychosocial variables will be associated with both the frequency of injecting any drug and the frequency of injecting cocaine.

2. Both cocaine injection and stress will be associated with unsafe sex. The second hypothesis seeks to extend what is known about unsafe sex among another group at increased risk for HIV infection, middle class gay men (Martin, 1990; Stall, 1986) where drug use does play a role in this behavior. Stress has been linked to relapse from safer sexual practices among middle class gay white males (Stall, 1990).

3. Among the entire group of intravenous drug users, the greater the report of stress and distress, the more symptoms will be reported. This hypothesis follows from the literature reviewed above concerning (a) stress and illness and (b) stress, distress, and the immune system.

4. Those individuals who are seropositive at baseline will be more likely to display clinical symptoms of ARC or AIDS (night sweats, unexplained fever lasting more than one month, unexplained weight loss of more than ten pounds, swollen lymph nodes, diarrhea, and mouth infections) or to die from AIDS by follow-up, 9 months later if, they score high on stress or distress or both than if they score low on these variables.

5. Stress and distress, taken both individually and additively, will be associated with changes in the level of CD4 cell count, CD8 cell count, total lymphocyte count, and changes in levels of immunoglobulins, IgA, IgM, IgG. This hypothesis also follows from the literature reviewed above on stress, distress, and the immune system.

6. Social support and race will serve as moderators of the (a) stress/distress and (b) risk behavior/symptom report/immune cell level change relationships: Those low in social support and/or black will show more negative stress and distress effects.

METHODS

The data used in this study are part of a larger ongoing study of risk factors for AIDS among intravenous drug users in New York City (National Institute on Drug Abuse Grant number 03594; Don C. Des Jarlais, principal investigator). Variables applicable to stress and emotional distress have been extracted from the larger data set.

The original study was begun by recruiting subjects from drug detoxification units and outpatients from methadone maintenance programs at Beth Israel Hospital and the Veterans Administration Hospital located in Manhattan, between May and December, 1984. All patients willing to take part were enlisted with the exception that participants who had sought or were seeking treatment for either AIDS or ARC were excluded. All subjects participated on a voluntary basis, with assurances that confidentiality of interview responses and blood test results would be maintained and that participation or refusal to participate would not affect their status within the drug treatment program. Subjects were paid $15 after the interview was completed. The present study is concerned largely with a sample that was recruited in a similar manner in 1986 from Bellevue Hospital in New York City and consists exclusively of

methadone patients. This sample was followed up in 1987 when additional blood samples and interviews were done.

A face to face interview using a structured questionnaire was administered in private by a postdoctoral fellow and several physician's assistants, trained by personnel on the risk factor project. The questionnaire gathered information on frequency of drug injection, drug using history, sexual behavior, medical history, emotional distress and mood, and frequency of occurrence of a number of stressful events.

The Sample

The sample consists of 160 intravenous drug users. While truly representative samples of IV drug users in a community are probably impossible to obtain, intravenous drug users entering treatment are probably the best convenience samples for monitoring trends among IV drug users in a community; this type of sample has been adopted by the Centers for Disease Control "family of surveys" (S. Jones M.D., oral communication, March, 1988) and by the World Health Organization for its proposed studies of HIV

exposure among IV drug users (M. Carballo PhD, oral communication, March, 1988) (Des Jarlais et al, 1989).

Females were somewhat over represented in this sample. One third are female and two thirds are male. According to data on persons entering drug treatment programs, females constitute 27% of the IV drug users in New York City (Des Jarlais and Friedman, 1988). The individuals in this sample are poor. Sixty three percent reported their income from all legal jobs during the previous year to be below $10,000. Only 7.9 % had legal income above $20,000 annually. Demographics of this sample appear in Table 1.

Table 1

Demographic Characteristics of the Respondents

	n	%		n	%
Sex male	107	67	Marital single	77	48
female	53	33	married	42	26
Ethnicity white	59	37	divorced	14	9
black	46	29	widowed	5	3
Hispanic non black	44	27	separated	22	14
Hispanic black	9	6	Total	160	100
missing	2	1			
Total	160	100			
Age mean	35.7		Years Ed. <8	7	4
under 25	8	5	8	11	7
25-30	28	17	9-11	62	39
31-35	48	30	12	39	24
36-40	42	26	13-15	29	18
41 and over	34	21	16	8	5
			>16	4	2
Total	160	99		160	99

A hazard of doing research on a population such as this one, which often has few stable roots in the community, is the difficulty of follow-up. The original group at time 1 consisted of 224 individuals. For subjects who left treatment, data collection included attempts at contact by telephone and mail. Nevertheless, 61 subjects were lost to the study between the initial and follow-up interview. Five subjects died of AIDS and are included in the study. Three who died of unrelated causes are among those lost. A table displaying characteristics of those who remained and those who were lost to the study appears in Table 2. Both demographics and mean scores on the study's central variables are presented. Homelessness does not appear to be a factor in the loss of subjects. The individuals who remained were as apt to have spent time without a place to live as those who were lost. Fewer people were seropositive in the group which was lost. Stress and distress were comparable for both groups at time 1. Overall, subjects who were interviewed at time 1 and time 2 (study group) are similar to the study dropouts on most demographic characteristics and dependent variables.

Table 2

Comparison of Study Group and Those Lost at Time 2

	Study Group N=160		Lost Group N=61	
	n	%	n	%
Sex male female	 107 53	 67 33	 46 15	 75 25
Mean age	35.7		36.3	
Marital Status single	 77	 48	 22	 36
married	42	26	17	28
separated	22	14	4	7
divorced	14	9	11	18
widowed	5	3	3	5
missing	-	-	4	6
Total	160	100	61	100
Ethnicity white	 59	 37	 15	 25
black	46	29	17	28
Hispanic non black	44	27	19	31
Hispanic black	9	6	3	5
missing	2	.01	7	11
Total	160	100	61	100
Positive serostatus	76	47	21	34
Mean stress score		3.8		3.5
Suicidal thoughts	65	41	30	49
Suicide attempts	15	.09	7	12
Depression	78	49	27	44

Measurement

HIV status and Immune Measures

Twenty five ml of blood were collected from each subject at intake and at the follow-up interview nine months later. Blood was drawn prior to administration of the questionnaire using the same procedure at both times. Lymphocyte enumeration and subtyping of specimens from subjects were preformed at the New York City Department of Health Laboratory with 5 ml of blood collected in EDTA-containing tubes. Lymphocyte subsets were determinedwith the whole blood lysis methods using fluorescein-labeled monoclonal antibodies OKT3, OKT4, OKT8 (Ortho-Mune, Raritan, N.J. and B1 (Coulter) (Zolla-Pazner et al, 1987). A Coulter EPICS C flow cytometer was used. The percentage of each ly,phocyte subset was based on the percentage of fluorescent-positive cells within the population of viable lymphocytes defined by gating the cytofluorgraphic analysis of mononuclear cells using narrow-angle and 90^0 light scatter (ibid). The absolute number of lymphocytes for each subset was obtained by multiplying the percentage of that subset by the number of lymphocytes per mm^3 determined by a differentialo leukocyte count. Immunoglobulins were quantified with a rate nephelometer using anti-IgA, anti-IgG, and anti-IgM reagents (Beckman). Measures included

counts of total lymphocytes, CD 4 cells, CD 8 cells, CD4/CD8 ratio, B cells, Immunoglobulin A (IgA), Immunoglobulin G (IgG), and Immunoglobulin M (IgM).

Aliquots of serum from the subjects were analyzed at the New York City Department of Health Laboratories for antibody to HIV by an ELISA (Abbott); all tests were confirmed by immunoblot. It was found that 47% were seropositive at baseline. This percentage remained the same at follow-up, nine months later although five seropositive people had died of AIDS by follow-up.

Stress

The way in which stress was measured in this study was shaped by the available data. The actual items appear in the Appendix. Table 3 summarizes the stressors included in the measure. Choice of specific items was guided by previous research, including Dohrenwend's advice to examine stressors distinctive to the group under study. Thus, items like spending time without a place to live were included although not commonly present in inventories of stressors (Holmes and Rahe, 1967; Dohrenwend, Krasnoff and Dohrenwend, 1978). Some measures of chronic stressors include unemployment, homelessness and hunger. Some measures are acute events,

such as being arrested. None are trivial, and none are "hassles" (Lazarus and Folkman, 1984).

Hassles have been defined as everyday irritants, such as missing a bus (De Longis et al, 1982). Although hassles or microstressors apparently affect daily mood (Eckenrode, 1984), Mirowsky and Ross (1989) are probably correct in saying that including them can trivialize research. Particularly in a population such as this one, which is subjected to more than their share of acute events and chronic stressors, the measure of stress is limited to the acute stressful events and chronic strains to which these individuals are subjected.

When formulating questions about stressors, any list is a sample representing a larger population of events (Dohrenwend et al, 1978). Some events are widely experienced, such as losing a job. Some vary with social and cultural settings. Dohrenwend and his colleagues (1978) counsel that the best defense against sociocultural parochialism is to query a sample of persons from the setting in which the life events list will be used prior to constructing the stress measure. Mechanic (1989) has also made the valid criticism that most social surveys typically separate behavior from the particular social and cultural context in which it is embedded. Care was taken by the

principal investigator on the original risk factor study to avoid this.

Relying on a background of research on intravenous drug users and on the resources of Narcotic and Drug Research, Inc. (NDRI), the principal investigator included items in the questionnaire which were typical stressors for this population. NDRI has the advantage of a street research unit of former addicts to collect enthnographic data to supplement their demographic information. Thus the items placed in the questionnaire as stress questions, as well as items from other sections of the questionnaire containing information relating to chronic strain are included in the stress measure. For example, the question "do you have a child with a serious health problem?" provides information about a possible source of chronic strain.

Concern about AIDS is also a source of chronic stress among intravenous drug users. This is not a well educated population, but this is a street-wise population. Des Jarlais (1986) found that all patients he interviewed in a methadone program in New York City knew of AIDS, and 93 percent knew that IV drug use was a way to get the disease. Selwyn (1986), in a survey of drug users in New York City, reported that 97 % of his sample knew that you can get AIDS from sharing needles. These individuals, all of whom are

drug users in New York City, gave an estimate of the percentage of drug users in New York City they believed were carrying the virus which causes AIDS. They also responded to the question, "do you think everyone who is exposed to the AIDS virus will eventually get sick from it?" The answers to these questions provide information about their sense of vulnerability to AIDS, a chronic stress.

Each subject's stress score reflected simply the number of stressors he or she reported experiencing among those asked about. No weighting scheme of any sort was used.

Table 3

Stress Questions

Time 1

1. currently unemployed
2. time without a place to live
3. less than high school education
4. arrested
5. time without a job
6. breakup of close personal relationship
7. child seriously ill
8. misses more than 10 meals per week
9. lost a job

Time 2

1. currently unemployed
2. time without a place to live
3. less than a high school education
4. arrested
5. time without a job
6. breakup of close personal relationship.
7. child seriously ill
8. misses more than ten meals per week.
9. belief that more than two thirds of IVDUs in N.Y.C carry HIV.
10. birth of a child
11. belief that everyone exposed to HIV will become sick.

Distress

On the initial interview at time 1, three questions concerning distress during the previous year were asked:

" Did you ever feel so depressed that you could not get out of bed in the morning?"

" Did you think about committing suicide?"

" Did you attempt suicide?"

Subjects responded "yes" or "no".

A subject's distress score reflects the number of these states he or she agrees to having experienced. The scores can thereby range from 0 to 3.

The measure of emotional distress on the 1987 Bellevue follow-up interview, conducted 9 months later with the same subjects, requires them to reflect on the last thirty days. This time, they are asked not simply whether they experienced distress, but how many times they felt particular symptoms. These symptoms are listed in table 4.

The score on each item is multiplied by the number of days they report having had one of the symptoms. These items, each with a range of 0 to 30, are then added to get

an overall distress measure for each person. This time 2 distress score has a potential range from 0 to 240, since a limit of time (30 days) is placed on each symptom (8 x 30).

The distress items at the follow-up interview are similar to those commonly used on such scales as the Hopkins Symptom Checklist (HSCL) (Derogatis et al, 1974). They have previously been shown to be sensitive to changes in psychological distress in drug users entering treatment programs that provide on-site counselling (Des Jarlais et al, 1987).

Table 4

Distress Questions
On how many of the last thirty days, did you:
1. Feel hopeless about the future?
2. Feel nervous or tense?
3. Worry too much about things?
4. Feel sad, blue, depressed, or lose all interest in things that you usually cared about or enjoyed?
5. Think a lot about death---either your own or someone else's, or death in general?
6. Feel so low that you thought of committing suicide?
7. Feel worthless, sinful, or guilty?
8. Feel so depressed that you could not get out of bed in the morning?

Stress Moderators

There are individual differences in two areas which may moderate stress effects, social support and race. There is evidence that the presence of one confidant significantly decreases the risk of depression (Brown et al, 1975; Lowenthal and Haven, 1968). Pearlin and Johnson (1977) have observed that marital status has had a long history and consistent empirical documentation as a promoter of psychological well-being. There are differences in these measures of social support among the people in this study.

Social support will be composed of answers to the questions:
"Are you living with someone with whom you have a sexual relationship?"
"Do you have a friend, relative or counsellor with whom you feel you can talk about problems and pressures?"

In addition to this more widely known stress moderator, social support, Kessler and his colleagues (1986) have recently called attention to the possibility that belonging to a minority racial may increase psychological distress. In a meta analysis of eight previous studies (n = 22,000), Kessler found significant effect for race independent of social class. In the present study, all of the participants

are lower class. Kessler suggests that the joint effects of poverty and discrimination might have a synergistic effect, or certain resources for coping with stress might be less available to lower-class blacks than to lower-class whites (Kessler and Neighbors, 1986).

As a moderator of the stress/distress effect, race will be considered white or black. Black will include black/Hispanic.

Risk Behavior for HIV Transmission

The frequency of injecting any drug and the frequency of injecting cocaine were based on common patterns of use for these drugs. The categories are shown in table 5.

Table 5

Categories for Reporting Drug Injection Frequency

never
no more than once per year
less than once a month
one to three times a month
weekly or once a week
two to three times a week
four to six times a week
about once a day (seven to ten times a week)
two or three times a day/almost every day
four or more times a day/almost every day

Unsafe Sex

A variable, unsafe sex, was computed by adding a number of risk factors in the area of sexual behavior to construct a score for each person. The decision to divide the question on sexual partners between those having one sexual partner and those having more than one was based on a frequency distribution and on conversations with the principal investigator on a heterosexual transmission project. The critical distinction on multiple partners seems to fall between those who are monogamous and those who are not (S. Tross, oral communication, March, 1989). The items included in the unsafe sex score are:

1. Having sex with someone who later developed AIDS
2. Having sex with someone who has been told that they have been exposed to HIV
3. Selling sex for money or drugs
4. Having more than one sexual partner
5. The number of sexual partners who use intravenous drugs.

Dependent Variables

The following are the dependent measures:

1. Certain high risk behavior, specifically, frequency of injecting drugs, frequency of injecting cocaine, and unsafe sex.

2. Death from AIDS

3. AIDS-related symptoms, specifically swollen lymph glands, unexplained fever lasting more than one month, night sweats, unexplained weight loss more than ten pounds, diarrhea, and mouth infections.

4. Change in immune system measures, specifically number of CD4 cells, number of total lymphocytes, number of CD8 cells, the CD4/CD8 ratio, number of B cells, IgM, IgG, and IgA in both those whose immune system is compromised because they are seropositive, and in those who are seronegative.

The blood measures available in this data and their function in the immune system are defined more carefully in the Appendix.

Data Analysis

To test the first hypothesis, that stress and distress, taken both individually and additively, will be associated with injecting drugs more frequently, an ordinary least-squares multiple regression was done with injection frequency at time 1 as the dependent measure and stress at time 1 and distress at time 1 as the independent variables. The analysis was repeated with demographics (sex, age, race, education) entered in the first stage, then introducing stress and distress. The procedure was repeated varying the order of entry of the independent variables. Controlling statistically for sociodemographic variables can underestimate the effects of psychological processes. Statistical control can overestimate the effects of sociodemographic, relative to the effects of psychological, variables as markers for underlying biological processes (Matthews, 1989). The results of both sets of regressions were compared. Results were also examined to see whether there is any significant additive effect of stress and distress when both have been entered into the regression.

A multiple regression was done with injection frequency at time 2 as the dependent variable. Demographics were again entered as a group. Frequency of injecting drugs at time 1, stress at time 2, and distress at time 2 were the independent variables. Regressions were again repeated varying the order of entry of the independent variables. These regressions were also done with and without demographics and the results compared.

The same procedures was followed with frequency of injecting cocaine at time 1 as the dependent variable and stress at time 1 and distress at time 1 as independent variables. This was repeated with frequency of injecting cocaine at time 2 as the dependent variable and frequency of injecting cocaine at time 1, stress at time 2, and distress at time 2 as the independent variables. Regressions were repeated varying the order of entry of the independent variables and with and without demographics.

To test the second hypothesis that frequency of cocaine injection and stress are associated with unsafe sex, an ordinary least-squares multiple regression was done with unsafe sex at time 1 as the dependent measure and frequency of injecting cocaine at time 1, and stress at time 1 independent variables. Demographics were entered at the first stage. The regression were repeated varying the order

of entry of the independent variables. Regressions were repeated without controlling for demographic variables.

These procedures were repeated with unsafe sex at time 2 as the dependent variable and stress at time 2, frequency of injecting cocaine at time 2 and unsafe sex at time 1 as the independent variables.

To test the third hypothesis, that among the entire group, the greater the level of stress and distress, the greater the level of symptoms, multiple regression were done with the presence of symptoms at time 1 as the dependent variable. Stress at time 1, distress at time 1, injection frequency at time 1 were the independent variables. Demographics were entered first as a group. Regressions were repeated varying the order of entry of the independent variables. Regressions were repeated without controlling for demographic variables. Results were also be examined for additive effects of stress and distress when they are entered into the regression.

These procedures were repeated with the presence of symptoms at time 2 as the dependent variable. Symptoms at time 1, injection frequency at time 1, stress at time 2, and distress at time 2 were the independent variables.

A logistic regression was done to test the fourth hypothesis, that seropositive subjects are more likely to have AIDS-related symptoms or to die from AIDS by time 2 if they score high on stress or distress or both than if they score low on these variables. This logistic regression used a time 2 binary dependent measure of symptomatic or dead from AIDS or alive and symptom free. Only individuals who were seropositive at time 1 are included. Stress at time 1, distress at time 1, frequency of injection and going to shooting galleries at time 1 were the independent variables.

For the fifth hypothesis that stress and distress, taken both individually and additively are associated with changes in the level of immune cells, t-tests were done to see whether there is a significant difference between time 1 and time 2 cell levels for CD4 cells, CD8 cells, B cells, total lymphocytes and the immunoglobulins, IgA, IgG, and IgM. On cell counts with a significant difference in the level between time 1 and time 2, multiple regressions were done with time 2 cell count as the dependent measure and stress at time 2 and distress at time 2 as independent variables. The time 1 cell count was entered first in the regression. Individuals are idiosyncratic in their counts within a certain range and their own cell count at time 1 is believed to be the best predictor of time 2 cell count.

Correlations were done separately for seropositive and seronegative individuals between (a) those cell counts with significant difference between time 1 and time 2 (CD4, CD8, IgA, and IgM) and (b) the variables stress and distress.

To test the sixth hypothesis, that social support and race will serve as a moderator of the stress/distress effects in those immune level changes, symptom, and risk factor dependent measures which are significantly associated with these psychosocial variables, multiple regressions were repeated using a dummy variable for the category of race. They were then repeated using a dummy variable for the presence or absence of social support. Results for the psychosocial variables were then compared to the results obtained when the dummy variables were not included in the regression analysis.

RESULTS

Descriptive Statistics

We will begin with a description of the major independent variables and their distribution at both time 1 and time 2. Then we will describe the dependent variables and how they did or did not change from intake tc follow-up.

Both stress and distress were normally distributed at both times. The metrics of the two distress measures differ greatly. They are automatically standardized in the regression analyses below.

Table 6

Means, Standard Deviations, and Range of Independent Variables

	Mean	s.d.	Range
$Stress_{T1}$	3.9	1.5	0-8
$Stress_{T2}$	3.8	1.9	0-9
$Distress_{T1}$	.98	.87	0-3
$Distress_{T2}$	62	66	0-240

Information on the dependent variables are given in the following tables. A significant change in the frequency of injecting drugs occurred between intake and follow-up (Table 7). The people in this sample are all in methadone treatment, which is designed to affect injection behavior and did, in fact, produce a significant decline in the frequency of injecting any drug (Table 7)($t=4.5, p<.000$). Fifteen percent more respondents had ceased injecting drugs by time 2. While 25% were injecting drugs more than 4 times a week at time 1, only 8 percent were injecting so frequently by time 2.

Cocaine injection also declined significantly from time 1 to time 2 (Table 8) ($t=2.1, p<.03$). Five percent stopped injecting and none were reporting injecting more than 4 times a day by time 2.

Table 7

Frequency of Injecting Any Drug at Time 1 and Time 2

	Time 1		Time 2	
	N	%	N	%
never	56	35	77	50
once a year	7	4	16	10
< once a month	22	14	16	10
1-3 times a month	12	7	12	8
weekly	12	7	4	3
2-3 times a week	12	7	16	10
4-6 times a week	6	4	2	1
daily	5	3	4	3
2-3 times a day	14	9	7	4
4+ times a day	14	9	1	.6
Total	160	99	155	98

Table 8

Frequency of Injecting Cocaine at Time 1 and Time 2

	Time 1		Time 2	
	n	%	n	%
never	85	53	90	58
once a year	13	8	11	7
< once a month	12	7	9	6
1-3 times a month	17	11	12	7
weekly	2	1	2	1
2-3 times a week	12	7	17	11
4-6 times a week	5	3	3	2
daily	2	1	6	4
2-3 times a day	7	4	5	4
4+ times a day	5	3	0	0
Total	160	98	155	100

Unsafe Sex

A majority of intravenous drug users reduced needle sharing and increased the cleaning of needles in response to the AIDS epidemic (Friedman et al, 1990). On the other hand, most studies show that few intravenous drug users changed their sexual behavior to reduce their risk of AIDS (Friedman, Des Jarlais et al, 1987). In this sample, although the overall scores remained very similar at time 1 and time 2 (Table 9) ($t = .55$, $p<.58$), specific behaviors did decline, such as having multiple partners and selling sex for money or drugs. Scores remained similar because at time 1, only one person had sex with someone later diagnosed as having AIDS. As the epidemic progressed, larger proportions reported or realized that they were having sex with AIDS or AIDS-related complex patients (Table 9).

Table 9

Percent Engaging in Risky Sexual Behavior at Time 1 and Time 2

	Time 1	Time 2
	%	%
> one partner	37	28
IV drug partner m	18	18
IV drug partner f	27	23
AIDS partner	1	5
ARC partner	-	9
Sold sex for money or drugs	8	3

Illness Measures

AIDS-related symptoms at time 2 provides a better measure than symptoms at time 1. Symptoms at time 2 refers to symptoms reported during the time between time 1 and time 2, about a nine month interval, so that it is a time bounded measure. Symptoms at time 1 measures symptoms during the six years prior to the initial interview. Although individuals who had no symptoms were probably healthier than people who did have symptoms, conclusions cannot be drawn as readily from associations of the independent variables with symptoms at time 1.

Twenty percent fewer people reported AIDS-related symptoms at time 2 compared with the percentage at time 1. This is reasonable since the time frame is much shorter, nine months, compared to the last six years. While these symptoms are frequently present in HIV infected individuals, many, such as persistent fever, are also signs of other illness and are present in seronegative people when they become ill. The decline in symptoms may also be related to the decline in the frequency of injecting drugs. In addition, five individuals, the people who were the most ill, died from AIDS by time 2.

Table 10

Symptoms Reported by Respondents at Time 1 and Time 2

	Symptoms		No Symptoms				
	n	%	n	%	Mean	s.d.	Range
$Symptoms_{T1}$ N=160	82	52	78	48	.79	.96	0-4
$Symptoms_{T2}$ N=155	48	30	107	70	.54	1	0-6

Immune Measures

Several measures of immune cell counts, with different phenotype, showed significant differences from time 1 to time 2. These include CD4 cells, CD8 cells, immunoglobulin A, and immunoglobulin G. Changes (Δ) in the level of these cells between time 1 and time 2 is the mean of the difference when time 2 count is subtracted from time 1 count(Table 11). Since the absolute number of CD4 cells and CD8 cells was based on multiplying the percentage for that subset by the total number of lymphocytes for that subset, the difference between time 1 and time 2 lymphocyte count was tested. There was no significant difference between time 1 and time 2 total lymphocyte count ($t= 1.4$, $p<.15$).

Immunoglobulin A (IgA) normally increases consistently from the seronegative group, to the seropositive group, to patients with AIDS (Zolla-Pazner at al, 1987). CD8 and Immunoglobulin G (IgG) increase in early HIV infection and then decrease and this may account for some of the change in those people who are seropositive. The mean increase in CD4 levels at time 2 is puzzling. No standard definition or generally accepted value exists for a lower limit of normal for CD4 cells. Less than 500 has been used in at least one study (Zolla-Pazner et al, 1987) where less than 5% of the control group had CD4 cell counts of less than 513-558. This provides some indication of what is considered a low CD4 cell count.

Table 11

Mean Change in Immune Cell Level for Cells With Significantly Different Levels at time 1 and 2.

	Range	$Mean_{t1}$	Range	$Mean_{t2}$	Δ
CD4 Cells	31-2207	721	17-2816	800	+95
CD 8 Cells	184-3076	765	36-3525	851	+89
IgA	1-784	225	1-815	264	+34
IgG	975-8155	2138	787-7233	2487	+459

Table 11a

Mean Change in Immune Cell Level for Cells With Significantly Different Levels at Time 1 and Time 2 For Seronegative Subjects

	Range	$Mean_{T1}$	Range	$Mean_{T2}$	Δ
CD4 Cells	320-2238	973	228-2816	1053	121
CD8 Cells	184-2603	687	36-1908	721	25
IgA	1-784	234	5-770	238	20
IgG	975-9130	1758	787-1785	1785	12

Table11b
Mean Change in Immune Cell Level for Cells With Significantly Different Levels at Time 1 and Time 2 For Seropositive Subjects

	Range	$Mean_{T1}$	Range	$Mean_{T2}$	Δ
CD4 Cells	68-1305	456	17-1413	502	51
CD8 Cells	210-3260	866	206-3561	1014	156
IgA	1-587	223	1-1413	502	53
IgG	1370-6800	2621	1320-8020	3391	1080

Stress Moderators

Social support was unevenly distributed with only 9% lacking any support at time 1 and 10% at time 2 (Table 12).

Table 12

Distribution of Social Support at Time 1 and Time 2

	Social Support time 1		Social Support time 2	
	n	%	n	%
0	14	9	16	10
1	85	53	85	55
2	56	35	50	32
missing	4	2	4	2

Hypothesis Testing

With this preliminary information available, we will begin to look at each of the hypotheses individually to see whether stress or distress or some combination of these factors is associated with the dependent variables. In general, the research analysis takes the form of a repeated measures design, where there are two opportunities to look at behavior or illness in relationship to psychosocial variables. In some cases there are compelling reasons to believe that behavior at time 1 will influence outcome at time 2. For example, frequency of injection at time 1, will be included in multiple regressions where symptoms at time 2 is the dependent variable.

Injection Behavior

The focus in this section is on the association of stress and distress to the frequency of injecting (a) any drugs and (b) cocaine. Then we will go on to examine the association of stress and cocaine injection to unsafe sex.

The first hypothesis is that stress and distress, taken both individually and additively, will be associated with

injecting drugs more frequently. Since part of the analysis rests on self-report, a close association between respondents' reports of their injection frequency and certain biological indicators, such as serostatus, would tend to confirm their self-report. Frequency of injection is associated with conversion from a seronegative to seropositive for the HIV virus (Marmor, Des Jarlais et al, 1987; Weiss et al, 1985). A significant association exists between the respondents' serostatus and the frequency of injection behavior (Tables 13). Those reporting frequent injections have much higher proportions of HIV infection than those reporting less frequent or no injection ($t=2.7, p<.008$). Among those who injected drugs weekly or less than weekly, 36% were seropositive. Among those who injected drugs several times a week or daily, 72% were seropositive (Table 13).

Similarly, the decline in CD4 cells among those who are seropositive (Tables 13 and 17) is significantly greater among those reporting frequent injection than among those reporting less frequent injection. Des Jarlais and his colleagues (1988) reported that, even among those who are already seropositive, continued injection constitutes an increased risk because it is associated with greater CD4 cell decline than occurs in those not injecting frequently. In this sample, among those who are seropositive, 40% of

frequent injectors had a decline in CD4 cells, while 20% of less frequent injectors had such a decline. This is important because of the pivotal role CD8 cells play in the immune system. It has also been found that frequent injecting depresses lymphocyte function in both seropositive and seronegative intravenous drug users (Mientjes et al, 1990).

Table 13

Serostatus[1], Frequency of Injecting Any Drugs Weekly Compared to More Than Weekly, and CD4 Cell Loss at Time 1

	HIV-		HIV+		HIV+ CD4 Loss
	n	%	n	%	%
Injecting weekly or less N=106	67	62	39	36	20
Injecting more than weekly N=51	14	27	37	72	40

[1] 3 missing HIV status

A correlation matrix is presented with each hypothesis to assist the reader. It is easier to follow multivariate relationships if one has a guide to the bivariate associations. The p values are the significance level of two-tailed probabilities (Frude, 1987). The reader is aware that if 100 correlations are reported, somewhere around 5 may have observed significance levels of <.05 even when

there is no relationship among the variables (Norusis, 1988). No correlations are reported in the following results. Only multiple regression and analyses of variance were used to test the associations between the psychosocial variables and the dependent variables.

A correlation matrix for the dependent variables and independent variables used to test the first hypothesis, that stress and distress will be associated with the frequency of drug injection is shown in Table 14.

Table 14

Correlations Among Stress, Distress, Frequency of Injecting Any Drug

	S_{T1}	S_{T2}	D_{T1}	D_{T2}	Inj_{T1}	Inj_{T2}
Str_{T1}	1	.422	.291	.152	.368	.095
p<		.000	.000	.056	.000	.232
Str_{T2}	.422	1	.145	.423	.112	.075
p<	.000		.06	.000	.159	.34
$Dist_{T1}$	.291	.145	1	.298	.16	-.02
p<	.000	.068		.000	.04	.84
$Dist_{T2}$	.152	.423	.298	1	-.001	-.07
p<	.056	.000	.000		.90	.37
$InjFr_{T1}$	.365	.112	.16	-.001	1	.266
p<	.000	.159	.04	.90		.001
$InjFr_{T2}$	.089	.033	-.02	-.071	.266	1
p<	.26	.679	.84	.37	.001	

S_{T1} stress time 1

S_{T2} stress time 2

D_{T1} distress time 1

D_{T2} distress time 2

Inj_{T1} frequency of injection time 1

Inj_{T2} frequency of injection time 2

To examine the relationship between stress, distress, and injection behavior, an ordinary least-squares regression model that predicted frequency of injecting any drug at time 1 from stress at time 1 and distress at time 1 was tested. This was repeated, adjusting for sex, age, race, and level of education, entered first into the regression as a block. Table 15 shows the unstandardized regression coefficients (bs), their standard errors derived from these models, R square change, and the significance of F both with and without the demographics controlled. When stress at time 1 was entered into the multiple regression equation, with drug injection frequency at time 1 as the dependent variable, the R square change was .13 (p=<.000). When controlling for the effects of demographics, the relationship between stress at time 1 and injection frequency at time 1 remains significant (p=<.000), accounting for 9% of the variance (Table 15a). It is also clear from this table that even when distress is entered into the regression before stress, it is stress which is significantly associated with frequency of injection.

Both with and without demographics controlled, there are strong and significant associations between stress at time 1 and frequency of injecting drugs at time 1. This is not true at time 2. This finding prompted further analysis which extended beyond the hypotheses and these results will

be taken up in the discussion. For the present, it will simply be said, that stress and distress play a role in who continues to inject drugs while in this methadone treatment program. The results at time 2 for the entire sample are shown in Table 16 for comparison. To clarify the relationship of stress with the frequency of drug injection at time 2, a separate analysis was conducted using only those who were still injecting drugs at time 2 (Table 16a). This reduced the size of the sample to 78, but increased the significance level from $p<.53$ to $p<.17$ for stress and for distress from $p<.34$ to $p<.08$. Those who are still injecting at time 2 have a mean stress score above the group mean, while those not injecting have a mean score below the group mean. This difference is not significant for stress, but it is for distress ($t=-2$, $p<.029$). The association of distress to frequency of injection is complicated and will be taken up in the discussion section.

Table 15

Results of Multiple Regression to Predict Frequency of Injection at Time 1 From Stress and Distress.

	b	β	R Sq Change	F Change	Sig. F Change	Total
$Stress_{T1}$	9.9	.35	.13	24	.0000	.0000
$Distress_{T1}$	3.2	.06	.003	.64	.42	.42

Table 15a

Results of Multiple Regression to Predict Frequency of Injection at Time 1 From Demographic Variables and Stress and Distress.

	b	β	R Sq Change	F Change	Sig. F Change	Total
Age	-.37	-.05				.48
Race	-7	-7				-.007
Sex	-7	-.08				.30
Ed	.42	.04	ALL .03	ALL 1.2	ALL .28	61
$Distress_{T1}$	4.2	.08	.026	4	.04	.32
$Stress_{T1}$	9.7	.33	.09	15	.0002	.0002

Table 16

Results of Multiple Regression to Predict Injection Frequency at Time 2 From Stress, Distress and Injection Frequency at Time 1 Using Entire Sample (N=155)

	b	β	R Sq Change	F Change	Sig. F Change	Total
$Stress_{T2}$	.58	.05	002	.39	.53	.53
$Distress_{T2}$	-.02	-.08	.008	.67	.26	.34
$InjFreq_{T1}$	.11	.26	.07	11	.0008	.001

Table 16a

Results of Multiple Regression to Predict Frequency of Injecting Drugs at Time 2 From Stress and Distress Using Those Still Injecting at Time 2 (N=78)

	b	β	R Sq Change	F Change	Sig. F Change	Total
$Stress_{T2}$	1.7	.12	.004	.33	.56	.17
$Distress_{T2}$	-.08	-.21	.05	3.9	.05	.08
$InjFreq_{T1}$	.08	.16	.02	2	.15	.15

Cocaine Injection

The second part of the first hypothesis is that stress and distress will be associated with the frequency of injecting cocaine. Agreement between self-report of frequency of cocaine injection and serostatus is similar to that found in the case of injecting any drug.

Among those who reported no injection of cocaine, 39 percent were seropositive, while those who reported injecting cocaine had a seropositive rate of 59 percent (Table 17).

Table 17

Serostatus[1] And Frequency of Injecting Cocaine.

	HIV-		HIV+	
injects	N	%	N	%
never N=84	51	61	33	39
injects N=73	30	41	43	59

[1] 3 missing serostatus

A correlation matrix for frequency of cocaine injection and the independent variables is provided (Table 18).

Table 18

Correlations Among Stress, Distress, and Frequency of Injecting Cocaine.

	Str_{T1}	Str_{T2}	$Dist_{T1}$	$Dist_{T2}$	$CocIn_{T1}$	$CocIn_{T2}$
Str_{T1}	1	.422	.291	.152	.288	.067
p<		p.000	p.000	p.056	p.000	p.39
Str_{T2}	.422	1	.145	.423	.122	.049
p<	.000		.068	.000	.12	.53
$Dist_{T1}$	.291	.145	1	.298	.037	.032
p<	.000	.068		.000	.64	.68
$Dist_{T2}$	.152	.423	.298	1	-.057	.136
p<	.05	.000	.000		.47	.087
$CocIn_{T1}$	.288	.122	.037	-.057	1	.31
p<	.000	.123	.64	.47		.000
$CocIn_{T2}$	.067	.049	.032	-.136	.31	1
p<	.39	.54	.68	.087	.000	

Stress at time 1 is significantly associated with frequency of injecting cocaine at time 1 (Table 19). The R square change for stress at time 1 is .083. When distress at time 1 was entered, the R square change was only .002. With demographics entered first, the R square change for stress at time 1 (.0818) remained significant ($p<.0002$). When all variables were entered, stress remained significant at the .0004 level. Varying the order of entry of the independent variables did not alter the results. The entry of distress changed the significance level of the regression equation, as a whole, from $F = 2.9$ $p<.015$, after stress was entered fifth, following the demographics as a group, to $F = 2.5$ $p<.025$. The entry of distress, therefore, lowered the significance level of the overall equation.

While distress is unrelated to cocaine injection at time 1, for those who are still injecting cocaine at time 2, distress has a negative correlation with cocaine injection (Table 20). As with frequency of injecting any drug, the association of distress with frequency of injecting cocaine was stronger when those who were still injecting cocaine at time 2 were analyzed separately (Table 21). Cocaine injection is associated with dysphoric mood. Withdrawal from heroin produces physical symptoms (Rubington, 1967). Cocaine withdrawal does not cause physical symptoms (VanDyke and Byck,1982). However, the depression following the

cocaine high acts as a powerful psychological motivator to continue injection (Van Dyck and Byck, 1982). In light of this, it is plausible to believe that the negative beta weight for distress indicates that as cocaine injection rises, distress subsides, at least temporarily. The reverse, that as distress rises, cocaine injection falls, is not consistent with previous literature. Batki (1989) found exactly the opposite, that it was the most distressed, i.e. those with high scores on the Beck Depression Inventory who continued drug injection while in methadone treatment.

Table 19

Results of Multiple Regression to Predict Frequency of Cocaine Injection at Time 1 From Stress and Distress.

	b	β	R Sq Change	F Change	Sig. F Change	Total
Str_{T1}	5.7	.3	.083	14	.0002	.0002
$Dist_{T1}$	-1.7	-.05	.002	.41	.52	.52

Table 19a

Results of Multiple Regression to Predict Frequency of Cocaine Injection at Time 1 From Demographics Variables and Stress and Distress.

	b	β	R Sq Change	F Change	Sig. F Change	Total
Age	-.07	-.01				.82
Race	2.5	.03				.65
Sex	-2	-.01				.69
Ed	.49	.07	ALL .009	ALL .36	ALL .83	.40
$Stress_{T1}$	6.3	.32	.082	13	.0004	.0004
$Dsitress_{T1}$	-1.7	-.05	.002	.35	.55	.55

Table 20

Results of Multiple Regression to Predict Frequency of Cocaine Injection at Time 2 From Stress and Distress.

	b	β	R Sq Change	F Change	Sig. F Change	Total
$Stress_{T2}$	.81	.10	.0008	.12	.23	.23
$Distress_{T2}$	-.04	-.19	.03	4.8	.03	.03

Table 20a

Results of Multiple Regression to Predict Frequency of Cocaine Injection at Time 2 From Demographics Variables and Stress and Distress.

	b	β	R Sq Change	F Change	Sig. F Change	Total
Age	.04	.02				.81
Race	-4	-.11				.18
Sex	1	.04				.59
Ed	.14	.04	ALL .009	ALL .36	ALL .83	.81
$Stress_{T2}$	.7	.08	.00009	.01	.91	.34
$Distress_{T2}$	-.04	-.2	.03	5.3	.02	.02

Table 21

Results of Multiple Regression to Predict Frequency of Cocaine Injection at Time 2 From Stress and Distress Using Those Still Injecting Cocaine at Time 2 (N=65)

	b	β	R Sq Change	F Change	Sig. F Change	Total
$Stress_{T2}$	2.7	.24	.002	.13	.71	.06
$Distress_{T2}$	-.14	-.44	.16	12	.001	.001

Unsafe Sex

The second hypothesis is: unsafe sex will be associated with stress and frequency of cocaine injection. A correlation matrix of the dependent variables and independent variables used to test the second hypothesis is provided (Table 22).

Table 22

Correlations Among Stress, Frequency of Cocaine Injection and Unsafe Sex.

	Str_{T1}	Str_{T2}	CI_{T1}	CI_{T2}	US_{T1}	US_{T2}
$Stress_{T1}$ p<	1	.422 .000	.287 .000	.067 .395	.206 .009	.169 .038
$Stress_{T2}$ p<	.422 .000	1	.122 .12	.048 .54	-.02 .79	.163 .045
$Coc.Inj_{T1}$ p<	.287 .000	.122 .12	1	.31 .000	.232 .003	.139 .08
$Coc.Inj_{T2}$ p<	.067 .395	.049 .53	.311 .000	1	.0009 .99	-.11 .17
$UnSex_{T1}$ p <	.206 .009	-.021 .79	.232 .003	.0009 .99	1	.165 .043
$UnSex_{T2}$ p<	.169 .038	.162 .045	.140 .086	-.11 .175	.165 .175	1

An ordinary least-squares regression procedure was preformed predicting unsafe sex at time 1 with unsafe sex

at time 1 as the dependent variable, and cocaine injection at time 1 and stress at time 1 as independent variables (Table 23). Cocaine injection was significantly associated with unsafe sex (R square change .04 <.02). Stress at time 1 was not significantly associated with unsafe sex (<.06). However, when demographics were entered first into the equation, stress at time 1 (<.03), race (<.02), cocaine injection at time 1 (<.02), and years of education (<.002) were significantly associated with unsafe sex at time 1, together accounting for 17% of the variance (Table 23). Although demographics as a group were not associated with the dependent variable, unsafe sex, race appears to be. The relationship of race with the other predictor variables was examined. There is no difference in this sample between blacks and non-blacks on frequency of cocaine injection at time 1 ($t=.38, p<.70$) or on gender distribution. There is a difference in stress score at time 1 ($t=3.7$, $p<.000$) with white subjects scoring higher in stress. Possible reasons for this are in the discussion section. Additionally, 40% of black subjects did not report risky sexual behavior, while only 28% of white subjects reported no risky sexual behavior. Thirteen percent of white subjects had scores of 3 or above, while only 2% of blacks did. These groups were significantly different on this variable ($t=2.9, p<.005$).

Table 23

Results of Multiple Regression to Predict Unsafe Sex at Time 1 From Stress at Time 1 and Frequency of Cocaine Injection at Time 1.

	b	β	R Sq. Change	F Change	Sig. F Change	Total all vars p<
Str_{T1}	.10	.15	.04	7	.009	.060
$CocIn_{T1}$	6.6	.18	.03	5.5	.020	.020

Table 23a

Resuts of Multiple Regression to Predict Unsafe Sex at Time 1 From Demographics Variables and Stress at Time 1 and Frequency of Cocaine Injection at Time 1.

	b	β	R Sq Change	F Change	Sig. F Change	Total
Race	-.43	-.19				.02
Sex	.22	.10				.19
Ed	.06	.25				.002
Age	-1	-7	ALL .09	All 3.5	ALL .009	.93
$Stress_{T1}$	.12	.19	.05	8.4	.004	.03
$CocInj_{T1}$	6.4	.18	.03	5.5	.02	.02

Unsafe sex at time 1 ($p<.03$) and stress at time 2 ($p<.03$) were associated with unsafe sex at time 2 (Table 24). Cocaine injection at time 2 ($p<.15$) was not significantly associated with unsafe sex at time 2. When entering demographics first, no independent variable, except unsafe sex at time 1, remained significantly associated with unsafe sex at time 2.

Table 24

Results of Multiple Regression to Predict Unsafe Sex at Time 2 From Stress at Time 2, Frequency of Cocaine Injection at Time 2 and Unsafe Sex at Time 1.

	b	β	R Sq. Change	F Change	Sig. F Change	Total all Vars p<
$Stress_{T2}$	.09	.17	.03	4	.04	.03
$CocIn_{T2}$	-7	-.11	.01	2	.15	.15
$UnSex_{T1}$	.18	.19	.03	4.6	.03	.03

Table 24a

Results of Multiple Regression to Predict Unsafe Sex at Time 2 From Demographics Variables and Stress at Time 2, Frequency of Cocaine Injection at Time 2 and Unsafe Sex at Time 1.

	b	β	R Sq Change	F Change	Sig. F Change	Total
Race	-.09	-.04				.63
Sex	-.05	-.02				.75
Ed	-.02	-.11				.75
Age	2	.02	ALL .02	ALL .88	ALL .47	.82
$Stress_{T2}$	.07	.14	.02	2.4	.12	.10
$CocInj_{T2}$	-7	-.11	.01	2	.14	.16
$UnSex_{T1}$	.18	.19	.03	5	.03	.03

John Martin's (1990) research on the relationship between any type of drug use and unsafe sex, which was published as these analyses were underway, prompted a test of the association between frequency of injecting any drug at time 1 and unsafe sex. Frequency of cocaine injection was chosen based on the literature which indicates a link between cocaine use and hypersexuality. Heroin, the other drug most frequently injected, generally produces a somnolent state and even impotence (Henneberger, 1990). When using the frequency of injecting any drug at time 1 as a predictor of unsafe sex, a more significant association is shown with unsafe sex, than occurs between frequency of injecting cocaine at time 1 and unsafe sex at time 1. This

may result from the fact that the drug most commonly injected aside from heroin is a "speedball", which is a combination of heroin and cocaine. This combination does not produce the "downer" effects of heroin injected alone. Since multicollinearity between stress at time 1 and frequency of injecting any drug at time 1 (R=.422) presents a problem, the results are reported separately when stress is entered first (Table 25), followed by the results when injection frequency is entered first (Table 25a). This shows that when stress is entered first, it assumes a larger share of the R square change, and the significance of injection frequency is less than when injection frequency is entered first. Nevertheless, the significance level for injection frequency remains high regardless of when it is entered into the regression and always exceeds the significance level of frequency of cocaine injection at time 1.

Table 25

Results of Multiple Regression to Predict Unsafe Sex at Time 1 From Frequency of Injecting Any Drug at Time 1 and Stress at Time 1.

	b	β	R Sq Change	F Change	Sig. F Change	Total p<
$Stress_{T1}$ entered first	.08	.12	.04	6.9	.009	.14
$InjFreq_{T1}$ entered second	5.4	.23	.05	8	.005	.009

Table 25a
Regression of Frequency of Injecting Any Drug at Time 1 and Stress at Time 1 on Unsafe Sex at Time 1

	b	β	R Sq Change	F Change	Sig. F Change	Total p<
$InjFreq_{T1}$ entered first	5.4	.23	.08	13	.004	.005
$Stress_{T1}$ entered first	.08	.12	.01	2.2	.13	.14

Illness Measures

The third hypothesis is: those having more stress or distress or both will have more AIDS-related symptoms than those scoring low on these variables. A correlation matrix of the variables used to test this hypothesis is provided (Table 26).

Table 26

Correlations Among Stress, Distress, and Symptoms at Time 1 and Time 2.

	S_{T1}	S_{T2}	D_{T1}	D_{T2}	$Syml_{T1}$	Sym_{T2}
$Stress_{T1}$ p<	1	.422 .000	.291 .000	.152 .056	.114 .15	-.02 .82
$Stress_{T2}$ p<	.422 .000	1	.145 .06	.423 .000	.113 .15	.144 .07
$Distress_{T1}$ p<	.291 .000	.145 .068	1	.29 .000	.259 .001	.17 .03
$Distress_{T2}$ p<	.152 .056	.423 .000	.298 .000	1	.19 .015	.24 .002
$Symptoms_{T1}$ p<	.114 .15	.113 .15	.259 .001	.19 .015	1	.399 .000
$Symptoms_{T2}$ p<	-.02 .82	.144 .07	.17 .03	.24 .002	.39 .000	1

As indicated earlier, symptoms at time 2 appears to be a more appropriate measure than symptoms at time 1 since it covers a much shorter period of time. Nevertheless, results concerning time 1 symptoms mirror results of time 2 symptoms. Distress, but not stress, is significantly associated with symptoms at both time 1 and 2 (Tables 27 and 28).

An ordinary least-squares regression model was used to predict symptoms at time 2 from frequency of injection at time 1, stress at time 2, distress at time 2 (Table 26). With symptoms at time 2 as the dependent variable, injection frequency at time 1 was entered into the regression first. This was significant at the .01 level. Entering stress did not change the significance level of the equation ($F = 4, p<.019$). Entering distress at time 2 raised the significance of the equation ($F = 5, p<.002$).

If symptoms at time 1 are included in the regression, distress remains barely significant ($p<.05$), while symptoms at time 1 are significant at the .0000 level. Frequency of injection at time 1 is also significantly associated with symptoms at time 2 ($p<.02$). This is to be expected since injection frequency is associated with both seroconversion and CD4 cell loss.

Table 27

Results of Multiple Regression to Predict Symptoms at Time 2 From Frequency of Injection at Time 1, Stress at Time 2, and Distress at Time 2.

	b	β	R Square Change	F Change	Sig. F Change	Total all vars p<
$Stress_{T2}$	.01	.02	.0005	.08	.76	.76
$Dist_{T2}$	3.6	.23	.06	9.6	.002	.007
Inj_{T1}	4.2	.18	.034	6	.01	.02

Table 27a

Results of Multiple Regression to Predict Symptoms at Time 2 From Demographic Variables and Frequency of Injection at Time 1, Stress at Time 2, and Distress at Time 2.

	b	β	R Sq Change	F Change	Sig. F Change	Total
Age	-7	-.05				.75
Race	.3	.15				.05
Sex	-.26	-.12				.21
Ed	-7	-.03	ALL .02	ALL .7	ALL .58	.71
$Stress_{T2}$	.03	.05	.02	2.5	.11	.78
$Distress_{T2}$	3.9	.24	.05	7.3	.007	.005
$InjFreq_{T1}$	4	.19	.03	5.7	.02	.02

Table 28

Results of Multiple Regression to Predict Symptoms at Time 1 From Stress, Frequency of Injection, and Distress.

	b	β	R Sq Change	F Change	Sig. F Change	Total p<
$Stress_{T1}$	-7	-.01	.0001	.02	.88	.88
$InjFreq_{T1}$	3.8	.15	.02	3.9	.04	.058
$Distress_{T1}$	.26	.24	.067	11	.001	.0036

Table 28a

Results of Multiple Regression to Predict Symptoms at Time 1 From Demographic Variables and Stress, Frequency of Injection, and Distress.

	b	β	R Sq Change	F Change	Sig. F Change	Total
Race	.25	.19				.16
Sex	.06	.03				.73
Ed	.03	.13				.11
Age	-3.3	-.02	ALL .02	ALL .77	ALL .54	.77
$Stress_{T1}$	.04	.07	.03	4.4	.03	.46
$FreqInj_{T1}$	3.3	.07	.02	4	.047	.07
$Distress_{T1}$	.24	.22	.04	6.6	.010	.01

The fourth hypothesis is: those exhibiting high stress, distress or both will be more likely to die of AIDS or to have symptoms than those who are low on these variables. This analysis used a subsample, those who were seropositive at time 1 (N= 76).

A logistic regression was used to test this hypothesis. The dependent variable was having symptoms at time 2 or having died of AIDS by time 2 versus having no symptoms at time 2. This dichotomous dependent variable was almost equally divided with 40 having no symptoms and 31 having symptoms, and 5 having died of AIDS by time 2 (40 vs. 36). With regard to the model itself, the Pearson goodness-of-fit chi-square was 75.9, significance level $p < .35$. Unlike other statistical tests, nonsignificance in the chi-square in logistic regression indicates that the model being tested provides a good fit with the data. This means that the difference between the expected distribution of cases using this model and the actual distribution of cases is so slight as to be nonsignificant (Walsh, 1987). However, none of the individual variables were significant. This may be related to the fact that the subsample is very small (n=76) and all of the people are seropositive. More importantly, we do not know when these individuals seroconverted from a negative to a positive state for HIV. It is therefore understandable that stress and distress do not differentiate symptomatic

individuals in this instance since time since seroconversion would overide other factors.

Immune Measures

The fifth hypothesis states that there is an association between stress, distress, and changes in the levels of immune cells from time 1 to time 2. The correlations for those immune cells whose level at time 2 was significantly different from time 1, CD4 cells, CD8 cells, Immunoglobulin A (IgA), and Immunoglobulin G (IgG) are given (Tables 29, 30, 31, and 32).

Correlations for changes in the level of immune cells with stress and distress were analyzed separately for seronegative and seropositive individuals. Correlations between (a) stress and distress at both time 1 and time 2 and (b) immune cell level change from time 1 to time 2, were frequently opposite for HIV positive and HIV negative subjects. This suggests a moderator effect for serostatus. Baron and Kenny (1986) indicate that "a moderator effect for serostatus within a correlational framework may be said to occur where the direction of the correlation changes". For example, the correlation between distress at time 2 with the mean change (Δ) in the level of CD8 cells from time 1 to

time 2, is .32 ($p<.007$) for seronegative individuals and +.34 ($p<.007$) for seropositive individuals.

Further indicators of a moderator effect are apparent in the multiple regressions (Tables 33 and 34). When regressions were done for the group as a whole, controlling for cell count at time 1, stress and distress were not significantly associated with change in the levels of CD4, CD8, IgA or IgG. When regressions were done for the two groups (HIV+ AND HIV-) separately, distress at time 2 was significantly associated with change in the level of CD8 cells from time 1 to time 2 for seronegative people ($p<.02$) (Table 34). For seropositive people, the significance level was $p<.06$, as compared to $p<.52$ for the group as whole. A further indicator of a moderator effect for serostatus is that serostatus is uncorrelated with the independent variable, distress.

An analysis of variance was done with the entire sample to examine the possible moderator effect of serostatus on distress. There was no direct effect for distress on CD8 cell level change, or for serostatus, but there was a significant interaction of distress and serostatus ($p<.003$)(Table 35).

The regressions with CD8 level change as the dependent variable indicate that among seronegative individuals, as distress goes up, CD8 level also rises. With the seropositive group, there is a negative association between distress and CD8 level change.

There may be a difference between seropositive and seronegative individuals, in the way stress and distress affects their level of important immune cells. Serostatus appears to moderate the effect of stress and distress on level of immune cells. Since the immune system of seropositive individuals is compromised, psychosocial factors may have more effect. Seropositive people injected drugs more frequently and this may affect rapidity of immune cell change. Any effect of psychosocial factors on immune cell level must be interpreted with caution since a variety of factors, such as change in nutrition and drug use affect immune function (Schleifer, Keller et al., 1989; 1985).

Table 29

Correlations of Stress and Distress With Change (Δ) in the Level of CD4 Cells From Time 1 to Time 2 Among Seronegative and Seropositive Persons

	HIV- n=84	HIV+ n=71
$Stress_{T1}$	.0009	-.25
p<	.99	.05
$Stress_{T2}$	-.005	-.21
p<	.96	.10
$Distress_{T1}$	-.04	-.23
p<	.76	.08
$Distress_{T2}$	.16	-.25
p<	.20	.05

Table 30

Correlations of Stress and Distress With Changes,in the Level of CD8 Cells From Time 1 to Time 2 Among Seropositive and Seronegative Persons

	HIV- n=84	HIV+ n=71
$Stress_{T1}$	.045 p<.71	-.29 p<.02
$Stress_{T2}$	.075 p<.54	-.20 p<.12
$Distress_{T1}$	.19 p<.11	-.20 p<.11
$Distress_{T2}$	.32 p<.007	-.34 p<.007

Table 31

Correlations of Stress and Distress With Changes in the Level of Immunoglobulin G Among Seropositive and Seronegative Persons

	HIV- n=84	HIV+ n=71
$Stress_{T1}$	.32 p<.02	-.009 p<.95
$Stress_{T2}$	.02 p<.89	.11 p<.50
$Distress_{T1}$	-.04 p<.73	.14 p<.40
$Distress_{T2}$	-.17 p<.23	.17 p<.29

Table 32

Correlations of Stress and Distress With Changes In the Level of Immunoglobulin A Among Seropositive and Seronegative Persons

	HIV- n=84	HIV+ n=71
$Stress_{T1}$	006 p<.95	.11 p<.47
$Stress_{T2}$	.28 p<.05	.07 p<.67
$Distress_{T1}$	.05 p<.71	.14 p<.38
$Distress_{T2}$	.27 p<.05	-.14 p<.38

Table 33

Results of Multiple Regression to Predict Change in Level of CD8 Cells From Stress and Distress Using Seropositive Subjects (N = 61)

	b	β	R Sq. Change	F Change	Sig. F Change	Total all vars
$CD8_{T1}$	-.44	-.39	.19	14	.0004	.001
$Distress_{T2}$	-2	-.25	.07	6	.01	.06
$Stress_{T2}$	-17	-.05	.002	.19	.66	.66

Table 33a

Results of Multiple Regression to Predict Change in Level of CD8 Cells From Demographic Variables and Stress and Distress Using Seropositive Subjects (N = 61)

	b	β	R Sq Change	F Change	Sig. F Change	Total all vars
Education	13	.06				.64
Age	22	.25				.04
Sex	328	.25				.03
Race	125	.10	ALL .21	ALL 3.7	ALL .010	.44
$CD8_{T1}$	-.42	-.38	.15	12	0008	.001
$Distress_{T2}$	-1.7	-.20	.05	4.5	.03	.12
$Stress_{T2}$	-25	-.08	.003	.31	.57	.57

Table 34

Results of Multiple Regression to Predict Change in Level of CD8 Cells From Stress and Distress Using Seronegative Subjects (N =68)

	b	β	R Sq. Change	F Change	Sig. F Change	Total all vars
$CD8_{T1}$	-.39	-.44	.21	19	.0000	.0000
$Distress_{T2}$	1	.25	.07	7.6	.007	.02
$Stress_{T2}$	9	.05	.003	.26	.60	.60

Table 34a

Results of Multiple Regression to Predict Change in Level of CD8 Cells From Demographic Variables and Stress and Distress Using Seronegative Subjects (N = 68)

	b	β	R Sq Change	F Change	Sig. F Change	Total all vars
Age	1.2	.02				.60
Race	1.3	1.7				.69
Education	-3	-.04				.69
Sex	11	-.01	ALL .02	ALL .45	ALL .77	.87
$CD8_{T1}$	-.39	-.45	.21	19	.0000	.0001
$Distress_{T2}$	1	.26	.06	5.8	.02	.04
$Stress_{T2}$	17	.10	.003	.29	.58	.58

Table 35

Analysis of Variance For Change in CD8 Cell Level By High and Low Distress and Serostatus (N=137)

	df	F	Sig of F
$Distress_{T2}$	1	1.4	.24
Serostatus	1	.68	.41
Interaction Distress/Serostatus	1	8.6	.004

Moderators of Stress and Distress

The sixth hypothesis is that social support will moderate the effect of stress. Correlations of social support, stress, distress, and risk behavior are provided (Table 36 and 37). These correlations were only significant for frequency of injection at time 1.

To examine whether lack of social support moderates the effect of stress, multiple regression analysis were repeated for each dependent variable which showed a significant association with stress and social support was included as an independent variable. The entry of social support did not change the significance level for stress.

An examination of the frequency distribution for social support (Table 12) made it clear that dividing groups into those having some support and those having no support would not be workable. An anlysis of variance was therefore done with those having no support, those with one source of support and those with both sources of support. Stress was split at the mean into high and low stress. These independent variables were used in an analysis of variance with each of the dependent variables which were significantly associated with stress. Only the analysis with frequency of injecting drugs at time 1 as the dependent variable showed a significant moderator effect for social support. This analysis indicated a direct effect for social support ($p<.003$) and a two way interaction for stress and social support ($p<.001$) on frequency of injection at time 1 (Table 38). Low stress individuals had low means for frequency of injection (range 5-13). For high stress individuals, those with no or one source of support had high ($X=54, 62$) rates of injection frequency. Those high stress individuals with both sources of support had low injection frequency ($X=8$). It is desirable that a moderator not be correlated with either the independent variable or dependent variable. Social suport is not significantly correlated with stress, but it is correlated -.17 ($p<.03$) with frequency of injection.

Table 36

Correlations of Social Support With Independent and Dependent Variables at Time 1

	Support	Stress	Dist	UnSex	FreInj	CocInj
Sup p<	1	-.03 .69	-.11 .15	-.10 .21	-.17 .03	-.14 .07
Str p<	-.03 .69	1	.29 .000	.21 .009	.36 .000	.28 .000
Dist p<	-.11 .15	.29 .000	1	.08 .33	.16 .04	.03 .68
UnSex p<	-.10 .21	.21 .009	.08 .33	1	.28 .000	.24 .003
FreInj p<	-.17 .03	.36 .000	.16 .04	.28 .000	1	.59 .000
CocInj p<	-.14 .07	.28 .000	.03 .68	.24 .003	.59 .000	1

Table 37

Correlations of Social Support With Independent and Dependent Variables at Time 2

	Support	Stress	Dist	UnSex	FreInj	CocInj
Sup p<	1	-.003 .96	-.10 .21	-.009 .91	-.007 .92	-.10 .20
Str p<	-.003 .96	1	.42 .000	.16 .04	.07 .38	.05 .53
Dist p<	-.10 .21	.42 .000	1	.10 .21	-.05 .51	-.13 .08
UnSex p<	-.009 .91	.16 .04	.10 .21	1	-.09 .27	-.11 .17
FreInj p<	-.007 .92	.07 .38	-.05 .51	-.09 .27	1	.69 .000
CocInj p<	-.10 .20	.05 .53	-.13 .08	-.11 .17	.69 .000	1

Table 38

Analysis of Variance with Frequency of Injection 1, High and Low Stress and Social Support at Time 1

	df	F	Sig of F
Stress	1	9.8	.000
Support	2	6	.003
2-way interaction	2	7.7	.001

The second part of the sixth hypothesis states that race will moderate the effect of distress; that black subjects will show more negative distress effects. Approximately one third of the subjects are black.

Correlations of stress, distress and race provided a picture that was counterintuitive. Race was negatively correlated with the independent variables, as color went from black to white scores increased (Table 39).

Table 39

Correlations Among Stress, Distress, and Race

	S_{T1}	S_{T2}	D_{T1}	D_{T2}	Race
$Stress_{T1}$	1	.42	.29	.152	-.27
p<		.000	.000	.056	.000
$Stress_{T2}$	.42	1	.145	.423	-.18
p<	.000		.06	.000	.023
$Distress_{T1}$	.29	.145	1	.298	-.14
P<	.000	.06		.000	.07
$Distress_{T2}$	.152	.423	.298	1	-.17
p<	.056	.000	.000		.03
Race	-.27	-.18	-.14	-.17	1
p<	.000	.02	.07	.03	

Race had no moderator effect on stress when stress was significantly associated with the dependent variables. However, race appears to moderate the effect of distress. Including race in the multiple regression as a separate independent variable with the dependent variable symptoms at time 2 changed the significance level for distress (Table 40).

Table 40

Significance Levels For Independent Variables and Symptoms at Time 2 With and Without Race Included in the Regression

	Without Race			With Race		
	β	R Sq Change	p<	β	R Sq Change	p<
$Stress_{T2}$	.02	.01	.76	.02	.01	.57
Race				.14	.01	.06
$Distress_{T2}$	.23	.06	.007	.24	.04	.004
$FreqInj_{T1}$	.18	.034	.02	.20	.039	.01

Analysis of variance indicates a direct effect for distress (p<.001) and an interaction effect for race and distress (p<.003) on symptoms at time 2 (Table 41). Those who were high in distress and black had the highest mean score on symptoms (Table 42). Interaction effects did not reach significance for symptoms at time 1, although the pattern was the same with those high in distress and black having the highest mean score on symptoms at time 1.

Table 41

Analysis of Variance of Race and High and Low Distress With Symptoms at Time 2

	F	df	p<
$Distress_{T2}$	12	1	.001
Race	2.7	1	.10
Interaction Race/Distress	9	1	.003

Table 42

Mean Scores For Symptoms at Time 2 by Race and High and Low Distress

	Black	White
Low Distress	.28	.36
High Distress	1.6	.61

This interaction effect of distress and race on symptoms at time 2 occurred even though blacks generally scored lower on distress than white subjects.

Including race as a separate variable also affected the significance of distress when change in the level of CD8 cells was the dependent variable (Tables 43 and 44).

Table 43

Significance Levels For Independent Variables and CD8 Level Change For Seronegative Subjects With and Without Race Included (N= 61)

	Without Race			With Race		
	β	R sq Change	p<	β	R Sq Change	p<
$CD8_{T1}$	.44	.21	.0000	.44	.19	.0002
Race				-3	.001	.97
$Distress_{T2}$	-.25	.07	.02	-.26	.08	.020
$Stress_{T2}$	-.05	.003	.60	-.09	.008	.39

Table 44

Significance Levels For Independent Variables and Change in CD8 Level For Seropositive Subjects With and Without Race Included (N=61)

	Without Race			With Race		
	β	R Sq Change	p<	β	R Sq Change	p<
$CD8_{T1}$	.12	.19	.001	.39	.19	.0008
Race				-.27	.09	.03
$Distress_{T2}$	.2	.07	.06	.24	.04	.05
$Stress_{T2}$	.05	.002	.66	-.06	.002	.65

Analysis of variance does not indicate an interaction effect for race and distress among seropositive individuals for change in the level of CD8 cells (Table 45). It does indicate a direct effect for race, with CD8 cells rising more for black subjects regardless of whether they are high or low in distress. Early HIV infection is characterized by a rise in CD8 cells which imbalances the CD4/CD8 ratio. Change in CD8 cells was calculated by subtracting time 2 count from time 1 count, so that if time 2 was the higher number, the result was a negative number (as 5 - 10 = -5). For black subjects, CD8 Cells rose 388 for low distress persons and 392 for high distress persons as comapred to 187 for white low distress people and 207 for white high distress people (Table 46). Since analysis did not indicate a moderator effect for race, this finding seems to be related to the fact that members of minority groups survive

for a shorter period after having been diagnosed as having AIDS than do Whites with the disease (Friedman et al, 1987a).

Table 45

Analysis of Variance For CD8 Level Change With Race and High and Low Distress For Seropositive Subjects (n=61)

	F	df	p<
$Distress_{T2}$	3	1	.08
Race	5	1	.03
Interaction Race/Distress	1.5	1	.22

Table 46

Mean Change in CD8 Level by Race and High and Low Distress For Seropositive Subjects (n=61)

	Black	White
Low Distress	-388	-187
High Distress	-392	-207

An interaction effect for race and distress was close to significance for frequency of cocaine injection at time 2 for those who were still injecting cocaine at time 2 (Table 47). Since this sub-sample was small(n=65), a significance level of 060 may suggest a moderator effect for race here as well.

Table 47

Analysis of Variance For Frequency of Injecting Cocaine For Subjects Injecting at Time 2 With Race and High and Low Distress (n = 65)

	F	df	p<
$Distress_{I2}$	10.9	1	.002
Race	3.6	1	.062
Interacton Race/Distress	3.7	1	.060

It was expected that blacks in this culture would experience greater distress. However in this sample, white subjects had higher scores on stress and distress at both time 1 and time 2. A comparison of scores for white and black subjects on the independent variables is provided (Table 48 and 49).

Table 48

Means for Stress and Distress for Black and White Subjects at Time 1

	Black n=55	White n=105			
	mean	mean	t	df	p<
$Stress_{I1}$	3.3	4.2	3.7	123	.000
$Distress_{I1}$	.8	1.1	1.8	113	.07

Table 49

Mean Scores For Stress and Distress For Black and White Subjects at Time 2

	Black n=51	White n=104			
	mean	mean	t	df	p<
$Stress_{T2}$	3.4	4	1.7	100	.09
$Distress_{T2}$	49	69	1.8	103	.06

Since these results were unanticipated, it was important to examine the items which were different for each group and to turn to the literature to understand these differences. These differences will be explored in the discussion section below.

DISCUSSION

The attempt to find psychosocial correlates of behavior which transmits the HIV virus among intravenous drug users was generally successful. Stress was significantly associated with frequency of injecting any drug and frequency of injecting cocaine at time 1 and with unsafe sex at both time 1 and time 2. Stress was not associated with frequency of injection at time 2. This finding is discussed below.

Mean distress scores at time 2 were significantly different for those who continued to inject drugs at time 2 and those who did not inject drugs. This distress was inversely associated with frequency of drug injection at time 2, suggesting that injection was used as a palliative for distress. The time 2 distress scale was a short term measure inquiring about anxiety and depression over the last thirty days. As frequency of drug injection rose among the group who were still injecting drugs at time 2, distress decreased, at least temporarily. There was no significant association between distress and frequency of injection at time 1, but the time 1 distress measure was not a short term measure, but a depression scale measured over the last year.

Distress was associated with symptoms as well, but stress was not. Although distress was associated with symptoms at both time 1 and time 2 in the group as a whole, these variables did not differentiate between symptomatic and non-symptomatic people in the subsample who were seropositive. This was probably due to the small size of the sub-sample and more importantly, to the fact that time of seroconversion was not known. That factor would clearly have a powerful impact on symptom development (Des Jarlais Friedman, Marmor et al, 1987).

There was no association of stress and distress with changes in the level of immune cells when the group was examined as a whole. Further analysis of seropositive and seronegative subjects separately uncovered an apparent moderator effect for serostatus on the impact of stress and distress on immune cell level as it changes over time.

In summary, psychosocial factors are important in planning interventions to reduce risk behavior among intravenous drug users. Stress or distress or both contribute to their injection behavior, sexual behavior and to their general health, as measured by their reports of symptoms. Perhaps, most important, there may be a difference between seropositive and seronegative individuals, in the way stress and distress affects their

level of important immune cells. Serostatus may moderate the effect of stress and distress on immune cells.

The significant difference in level of distress between those who are not injecting drugs and those who continue to inject drugs is important because it has implications for interventions to reduce risk behavior. It confirms the research of Batki, a notable exception to the neglect of inquiry on psychosocial correlates of risk behavior among intravenous drug users. Batki (1989) found scores on the Beck Depression Inventory predicted continued injection behavior among a group of methadone patients in California.

The association between stress and unsafe sex should be considered in planning interventions to change this behavior. Sexual behavior change among gay men, since the onset of the AIDS epidemic, has been impressive. , In a study of 604 New York City gay men, Martin (1990) found a decline from an annual average of 149 acts of unprotected intercourse in 1980-81 to 11.7 in 1986-87 ($p < .0001$). Altering risk behavior among intravenous drug users has been far less successful. For them, sexual behavior has been the most difficult to change. While a majority of intravenous drug users reduced needle sharing and increased the cleaning of needles in response to the epidemic (Friedman et al,

1990), few changed their sexual behavior to reduce their risk of AIDS (Friedman, Des Jarlais et al, 1987). In this sample, however, there is evidence of some decreased risk taking. Fewer persons sold sex for money or drugs and fewer had multiple partners at time 2. The items which made scores similar at time 1 and time 2 was having sex with someone later diagnosed as having AIDS or AIDS-related complex, an event which the person could not foresee.

Among intravenous drug users, ironically, safer sexual practices are more likely to occur in casual relationships than in committed relationships (Des Jarlais and Friedman, 1988). Keeping in mind that 75% of intravenous drug users have sexual partners who do not use drugs (Des Jarlais et al, 1984), interventions sensitive to specific cultural norms regarding sexual practice need to be developed. Particular attention should be paid to women's emotional or economic dependence upon their male partners and to the meaning of condom use in terms of women's self-identities. Cultural values that associate condom use with "bad" women and women in the sex industry and that relate the non-use of condoms to "good" women, increases the likelihood of HIV transmission within the family and to neonates.

The association found here between symptoms and psychological distress suggests either an etiologic

relationship between perceived AIDS risk and distress or an influence of distress on some path toward symptom formation, e.g. distress may affect the level of CD8 cells or both. Joseph and her colleagues (1988) concluded that psychological distress may adversely impact the health of the HIV-infected gay men in her study by influencing immune function.

Important information emerges even where the hypotheses were not confirmed, in those instances where associations of stress or distress with the dependent variables might be expected, but was not found. There was no significant association between stress and frequency of injection at time 2. Why is this so? We have argued for the position that drug injection is sometimes used as a method of coping with stress in the drug user's environment. Arnold (1990) also suggests that drugs are used to dull the pain of reality. She says that her respondents used drugs to minimize awareness of the harsh realities of survival in the streets. Perhaps being in a methadone program may act as a buffer for that stress enabling some clients to reduce injecting or cease altogether. It is interesting that there is a significant difference between those who are still injecting drugs at time 2 and those who are not in their level of reported distress. It is also possible that this result may be related to the significant decline in

injecting drugs at time 2 since the sample size of those still injecting (n= 65) may not have enough power to show effects for stress.

Those having higher distress are the ones who continue to inject drugs in spite of being in methadone treatment. The distress measure at time 2 is a short term depression and anxiety scale asking about mood over the last 30 days. Since the overall framework for this study suggests that one reason for injecting drugs is to cope with stressful conditions, it is plausible that distress is alleviated the more frequently one injects at least in the short run. This is clearly a maladaptive coping mechanism in the long run because it generates more problems, more stress, and more distress over an extended period of time. However this probably explains the inverse correlation between distress and frequency of injection. This inverse relationship of injection with distress is also observed for frequency of cocaine injection. Indeed, relieving depressive mood, appears to be a primary motivation for injecting cocaine. One well documented pharmacological effect of repeated cocaine use is the development of short term depression and high mood swings (Van Dyke and Byck, 1982).

Stress and distress were not associated with changes in levels of immune cells in the group as a whole. Additional analysis of seronegative and seropositive subjects separately indicated that these variables were in some instances correlated with changes in the levels of immune cells. This suggested that serostaus may act as a moderator of the effects of stress and distress on change in the level of immune cells from time 1 to time 2. This is further suggested by the fact that signs were frequently opposite, in HIV+ and HIV- subjects, for correlations of changes of the level of these cells with the psychosocial variables. Furthermore, when seropositive and seronegative subjects were examined separately using multiple regression analysis, a significant association was found between distress and changes in CD8 level among seronegative people. The association for seropositive people was not significant ($p<.06$), but the association was in the opposite directon from that of seronegative individuals. This also suggests that serostatus may moderate any effect distress may have on immune cell level. Seropositive people, who injected drugs most frequently, may induce more detrimental changes in their immune cell count. For this reason additional multiple regressions were done separately for seropositve and seronegative subjects with change in the level of CD 8 Cells as the dependent variable and injection frequency at time 2 included as an independent variable.

This was repeated using injection frequency at time 1 as an independent variable. Neither of these variables had a significant association with change in the level of CD 8 cells. Nevertheless, any effect of psychosocial factors on immune cell level needs to be interpreted with caution since a variety of factors, such as sharing needles which occurred too infrequently in this particular sample to be included in the analysis, changes in nutrition and drug use affect immune function (Schliefer, Keller et al, 1985, 1989).

A surprising finding was the difference between black and white respondents on their levels of stress and distress. Being homeless was less common among black respondents. Nine percent of white respondents were homeless, while only three percent of black respondents were. Blacks are more likely to regard individuals with whom they have strong friendship bonds as relatives or "fictive kin" (Leibow, 1967). Usually, no distinction is made between being related by legal or blood ties and being related by bonds of clan, neighborhood, or friendship. LaGory (1990) established the relationship between being homeless and distress. In examining a population which was in many respects similar to the one in this study, LaGory and his colleagues found high levels of depression among the homeless. Nearly three out of four people in his study exhibited "possible clinical caseness" with regard to

depression, and 59% showed signs of "probable clinical caseness".

One of the stress items asked about the sense of vulnerability to AIDS. Goodloe (1990) found that while knowledge about HIV transmission was no different between white and black groups she studied, denial of vulnerability was significantly higher among black respondents. In the present study, 43% of white respondents believed that almost everyone exposed to the HIV virus would eventually become sick from it, while only 24% of black respondents believed this. If this defense mechanism functions, it may be that those who do not believe that almost everyone infected with the virus will become ill experience less stress. If this defense mechanism fails, however, blacks may be experiencing a chronic stressor that is not tapped by the present measure.

In trying to understand why blacks report fewer days on which they experience symptoms of distress such as depression and suicidal ideation, a study by Jackson and her colleagues (1977) is informative. Jackson examined suicidal ideation among the elderly. She found that much of what white respondents found to be intolerable stressors, such as limited income, black respondents experienced as difficulties they had been coping with over many years. She

found suicidal ideation significantly less common among black respondents.

It is also possible that different distress scores for these two groups may be found in a sample at a different methadone treatment program. Treatment programs vary in their selection process, success in reducing drug injection behavior, and availability and adequacy of counselling (Ball et al, 1990).

Contribution to Existing Literature

In a special issue of the American Psychologist, entitled "Psychology and AIDS", Baum and Nesselhof (1988) commented that we need to know more about the processes by which risky behaviors are generated. Although risk factors have been uncovered among intravenous drug users, the processes by which these behaviors are generated have not been examined.

This research contributes to the existing literature because it extends the work on psychosocial factors related to risk behavior and symptom development to a group which is increasing in importance when dealing with the spread of AIDS. Previous research on psychosocial factors related to AIDS has used gay men as the study population. Even when

examining the effect of drug use on risk behavior, the best research (Martin, 1990; Stall, 1986) has used a population of white middle class gay men. This prior research is important since this was formerly the population where HIV infection was increasing. Their own efforts at behavior changed have reversed that process among gay men. Now intravenous drug users have become the population where HIV infection is spreading most rapidly.

Seventy five percent of drug users have their primary sexual relationship with a partner who is not a drug user (Des Jarlais et al, 1984). The overall percentage of female AIDS patients reported to the CDC has risen from less than one percent in 1981 to more than eleven percent in early 1990 (Centers for Disease Control, Atlanta). In New York and New Jersey, in 1987, HIV/AIDS was the third leading cause of death among women 15 to 44 years of age, and for black women in these states, it was the leading cause of death (Chu et al, 1990). In areas of New York City with high rates of drug use, seroprevalence rates of two to four percent were found among women giving birth (Chu et al, 1990). HIV infected women are the major source of infection for infants, indicating that trends among women forecast HIV mortality in children. Clearly it is important to examine the factors associated with risk behavior in this group.

For these reasons, extending this research on correlates of high risk behavior in populations at increased risk for HIV infection is important. Martin (1990) concludes his study on the association of drug use and unsafe sex, by warning that his findings are limited to middle-class urban gay males. He urges (p. 462) future studies on factors associated with risk taking in other populations.

The association found here between stress at time 1 and frequency of injecting any drug, frequency of injecting cocaine, and unsafe sex extends the literature to the population presently at highest risk. These findings are similar to those of Stall (1990), who reported at the recent international conference on AIDS about relapse from safer sexual practices among gay men. Among the reasons given for relapse was the influence of drugs and stress.

The association between distress and symptom development is consistent with the findings of Joseph (1988) and her colleagues that higher levels of depression and psychological distress were consistently and significantly associated with subsequent symptom development among gay men.

Limitations of the Study

It is important to consider shortcomings of this study. The data used in this research are among the best available on intravenous drug users. However, the research could be improved by an expanded measure of stress and a consistent distress measure at both interviews. The amount of data on stressful events which were collected in the larger risk factor study was limited by (a) time constraints and (b) the necessity of collecting other data for the urgent task of documenting those behaviors which were rapidly transmitting the HIV virus through this population. These behaviors, such as injection of cocaine, injection of other drugs, and unsafe sex have now been identified (Marmor et al, 1987; Chaisson et al, 1987;1988; Des Jarlais et al, 1987). A better measure of stress, specifically tailored to this population is urgently needed and will be considered below in the section on future research.

A second limitation of the present study is that the directionality of the association between distress and (a) symptoms and (b) changes in the level of CD8 cells is not known. Respondents knew whether they had tested positive for HIV by the time 2 interview either because they requested their results, as they were encouraged to do, or because they were given their results along with post-test

counselling at some point during their involvement with the methadone program. They did not know, nor did they seek to know, any changes which occurred in the level of their immune cells. One does not know whether distress was a factor in symptom development, perhaps by way of altering the level of some immune cells or whether knowledge of serostatus produced distress. Prior to the time when drugs were developed which appear to be of some effectiveness against HIV, the necessity of informing someone of his test results was not as compelling as it is now, since little could be done to treat him. During that period of time, Kessler and his colleagues (1988) examined distress in a cohort of gay men who were unaware of their serological status. He compared their scores on the Hopkins Symptom Checklist (HSCL) (Derogatis et al, 1974) with the norms established by Derogatis for the general population and for psychiatric outpatients. The average HSCL scores for this cohort of gay men was intermediate between those of the general population and those of a mixed psychiatric outpatient population (Kessler et al, 1988). In 9 of 10 comparisons (5 HSCL scales at each of 2 time points), distress scores were significantly greater ($<.05$) than the general population. Perceived symptoms increased distress regardless of serostatus suggesting that distress is influenced by psychological rather than biological processes. Joseph and her colleagues (1990), examining a

group of gay men in a 1987 sample found a significant increase in Hopkins Symptom Check List scores for depression and anxiety among those seropositive men who had test results disclosed to them. Neither of these studies address the issue of a possible role of distress in the etiology of symptoms. While the sample in this study may not be sophisticated enough to request their changes in the level of CD4 cells or CD8 cells, they may attach meaning to symptoms which they report. As Kessler (1988) has pointed out, it is reasonable to believe that individuals who experience AIDS-related symptoms will suffer distress similar to that of people diagnosed with other life-threatening illnesses.

Another limitation regarding distress is that, methodolologically, there may be effects arising from (a) differing time frames (nine months for distress at time 1; one month for distress at time 2), (b) differing content of the measures, and (c) possible effects for question phrasing. It may be easier to recall accurately distressed feelings over the last thirty days than it is to recall experiences over the previous nine months. Future studies would benefit from including both a short term mood measure, such as the time 2 measure and a standard depression inventory at both points in time. It is important to differentiate the contribution of each toward injection

behavior so that effective interventions can be planned. The occurrence of clinical depression is significantly higher among people who abuse drug (other than alcohol) than it is in the general population (Regier et al, 1990). The fact that cocaine cravings after withdrawal are relieved by antidepressants (Jarvik, 1990; Regier, 1990) suggests that short term mood swings also play an important role.

With regard to the possible effects of distress on immune cell level change, we do not know the ideal time frame for measuring such associations. Future studies would benefit from incorporating data collected subsequent to the data used in this research so that this association could be looked at over a longer period of time.

Whether these findings are applicable to intravenous drug users in general is also an important consideration. Individuals in methadone treatment programs, such as the ones in this sample, are very similar to street samples of drug users and quite different from middle class people entering a drug or alcohol treatment program. Methadone programs are normally not residential and this particular one was not. Clients live in the community and continue their usual lives. Individuals frequently enter treatment because they have been referred by the court and given the choice of jail or methadone treatment. Johnson (1985)

compared the the demographics of the street sample of intravenous drug users in his study of economics and crime to those of three samples from methadone programs in New York City and found them very similar. Additionally, in the only study of its kind, Rounsvalle and Klaybur found that a street sample of untreated opiate addicts were essentially similar in psychiatric diagnoses to opiate addicts in treatment (Rounsvalle and Klaybur, 1985). Des Jarlais (1989) has also addressed this issue. He says that while truly representative samples of intravenous drug users are probably impossible to obtain, drug users entering treatment are the best convenience sample for monitoring trends among IV drug users in a community; this type of sample has been adopted by the Centers for Disease Control "family of surveys" (S. Jones M.D., oral communication) and by the World Health Organization for its studies of HIV exposure among IV drug users (M. Carballo PhD, oral communication, March, 1988) (Des Jarlais et al, 1989).
Nevertheless, methadone programs differ from each other in the effectiveness of their counselling and their success in ending drug use (Ball, 1990).

Future Research

The most widely used stress measures were developed on middle class populations and contain items inappropriate for

assessing the experience of disadvantaged groups. Additionally, events uncommon to middle-class people, but frequently experienced by this population, are overlooked. This research remedies that to some extent. However, the need for an expanded measure tailored for this population is part of the research which still needs to be done.

Among the areas which should be addressed in such an expanded measure are availability of medical care, issues of physical safety, adequacy of housing, legal protection, availability and adequacy of drug treatment programs and the stress of pharmacological withdrawal.

The advent of AIDS highlights the problem of lack of health care among this population. Drug users die sooner after diagnosis with AIDS than gay men do (Friedman et al, 1987). This may be due to differences in seeking medical care, differences in the medical treatment which is available, differences in pre-existing health, or genetic or other reasons (Friedman et al, 1987). Gay men who have participated in research studies on AIDS tend to be middle class (Martin, 1990,1987; Joseph et al, 1990, 1987). Intravenous drug users tend to be poor (Johnson, 1985; Blumberg, 1973). The poor have less access to adequate health care (Wallace, 1990, Bullough, 1972). With regard to AIDS specifically, when a drug user goes to an emergency

room with symptoms, he may be admitted to the hospital, but will be released eventually with a prescription for a drug which he cannot afford. If he is involved in a methadone treatment program at a hospital, he will be able to obtain needed medication through that connection. The reality is that most intravenous drug users are not connected to the system either through treatment (Jarvik, 1990) or social services. In general, they are alienated (Des Jarlais, Friedman, Strug, 1986). AIDS is only the most dramatic of these problems. Even with normal medical conditions, such as pregnancy, adequate care is more difficult to obtain. Of course, a history of drug use often makes even such a normal condition a high risk situation requiring extraordinary care (Skolnich, 1990; Lynch and McKeon, 1990). Even if all necessary medical care could be obtained simply by enrolling in a methadone treatment program, all programs have waiting lists. Pregnant women, whose condition often provides motivation to abandon drug use, are frequently turned away from methadone programs, the most commonly available treatment in New York City, and told to return after delivery. Even therapeutic treatment communities, which are committed to a drug-free environment will not accept pregnant women (Stephen Sorrel M.D., personal communication, November, 1990). New York City's first community-based treatment program for pregnant substance abusers opened December 16, 1990 (Lee, 1990). Overall, there are fewer

than ten drug treatment programs in New York City that will accept a pregnant woman (Skolnich, 1990).

Availability of treatment is a problem for all substance abusers. The New York Sate Department of Substance Abuse Services estimates that there are more than 500,000 drug abusers in New York City, but treatment is available for 42,000 (Lee, 1990). To access drug treatment when it becomes available, the drug user must be willing to invest time in filling out forms and dealing with clerical workers and health providers - time which often sends him into withdrawal. The stress of pharmacological withdrawal is never included in measures of stress. Interaction with health care providers often includes the additional stressor of coping with attitudes of these middle class professionals toward intravenous drug users. Gay men have often had to cope with stigma when seeking health care, but they generally belong to the same socioeconomic class as the health providers which may mitigate the expression of prejudice. Availability of medical care, availability of drug treatment, and the problems associated with both are clearly items which need to be included in stress measures in this population.

This study does deal with the question of homelessness, but does not address the hidden homeless. People reporting

that they have a place to live often mean that they have a couch to sleep on in the apartment of a relative (Johnson et al, 1990; Johnson et al, 1985). This is a tenuous and unsatisfactory arrangement which frequently depends upon the individual's behavior and contributions which he can make to the household. This area needs to be probed to see whether the individual is reporting such an arrangement, or a single room occupancy, or a regular apartment.

Intravenous drug users are more likely to come into contact with the criminal justice system than are middle class people. While it is important to ask how many times they have been arrested as the present measure does, it is also important to know the legal protection which was available to them and whether they were abused physically. Physical assault is an issue which needs to be dealt with in all areas of their lives since drug users live in and frequent areas of the city which are more unsafe than middle and upper income areas.

Future research will benefit from data which have just been collected and those which are presently being collected. These data will make it possible to examine particular issues over several points in time and will further clarify the nature of some of the associations suggested by the present research.

Applications

Drugs are used by addicts, at least in part, as a method of coping with stress. If, however, drug use sets the stage for the occurrence of stressful events, the underlying conditions which have been linked to drug use by a variety of researchers (Williams, 1989; Reinarman and Levine, 1989; Blumberg, 1973; Johnson, 1985) still need to be addressed. Whatever the direction of the association between stress, distress, and drug injection, these psychosocial factors cannot be ignored when planning interventions to alter risk behavior.

The value of interventions to decrease high risk behavior has been demonstrated by the decline in the rate of growth of AIDS cases among gay men (Martin, 1990; 1987; Martin et al, 1989; Joseph et al, 1987). Unfortunately, research does not necessarily affect policy in many areas related to risk behavior and drugs. A Gallup poll indicates that between sixty to eighty percent of the public supports continued prohibition of psychoactive drugs (Gallup and Gallup, 1988). Elected officials are usually sensitive to such strong public sentiments. These strong sentiments

have contributed to the allocation of more than 70% of the total congressional appropriations for drug control to interdiction of supply with less than 30% available for treatment and prevention (Jarvik, 1990).

Research which suggests a link between drug use and stressful social conditions may influence the distribution of these funds, which have maintained the 70-30 split through 1990 (Jarvik, 1990). Numerous variables underlie drug abuse, including the chemical properties of the substances, the physiological and psychological conditions of the user, and social and environmental factors (Jarvik, 1990). Of these factors, the ones of most concern to a social psychologist and most susceptible to change by government policy is the environmental and social conditions.

The links suggested here between (a) stress and (b) the frequency of injecting any drug, injecting cocaine, at time 1, unsafe sex at both time 1 and time 2 provide an arena where politicians can advocate for change with impunity. Stressful social conditions, which no group seeks to uphold, provide an area where data can inform public policy without disastrous political consequences for proponents. Oblique attacks which are possible are better than direct attacks which are not possible.

In a limited effort that met with considerable success, such a process was undertaken in the national capital. In addition to a law enforcement effort, the city of Washington D.C. sent into one drug-plagued area recreation counselors and twice weekly mobile medical vans offering treatment to drug abusers. They also expanded day-care centers and held a job fair (Massing, 1990). This effort was undertaken partly because the head of Washington's Office of Drug Control Policy, Sterling Tucker, was aware that Washington's drug problem "is greatest in areas of greatest desperation".

If we addressed the problems underlying the stress and distress reported by this urban sample, problems such as lack of education, job assistance, supported employment, homelessness, child care, and economic redevelopment, we might experience greater success in reducing risk behavior and in winning the larger battle against the drug problem itself.

APPENDIX

Stress Measures

The following questions will be used as a measure of stress in the initial interview:

1. Are you currently employed?

2. Have you spent time without a regular place to live?

3. Have you spent at least a week out of work?

4. Do you have less than a high school education?

5. Did you lose a job?

6 . Have you been arrested or had other trouble with the law?

7. During the last year, did you have serious trouble in a close personal relationship, or a breakup of such a close personal relationship?

8. Do you have a child with serious health problems?

9. Weekly how often do you skip a meal?

1 to 4 times

5 to 9 times

10+ times a week

(Recoded 1 thru 9 = 0) (10 thru hi = 1).

The questions used to measure stress at time 2 are:

1. Are you currently employed?

2. How much of last year have you been without a regular place to live?

recoded 1 through 24 = 1; 25 through 52 = 2 .

3. During the last year, how many times have you been arrested?

Based on a frequency distribution, this was coded yes/no.

4. During the last year, did you have serious trouble in a close personal relationship, or the breakup of such close personal relationship?

5. Have you had a child with a serious health problem since we last interviewed you?

6. Do you have less than a high school education?

7. What percentage of drug users in N.Y.C. do you think are carrying the virus that causes AIDS?

recoded 0% to 67% = 0; 68% to 100 %1).

8. Do you think everyone who is exposed to the AIDS virus will eventually get sick from it?

9. Weekly, how often do you skip a meal?

10. How much of last year have you been out of work?
recoded 1 thru 24 = 1; 25 thru 52 = 2.

11. Have you or your spouse (lover) had a child since we last interviewed you?

Immune Measures

CD4 cells

These cells have a central role in controlling immune function. Among other functions, they recognize foreign antigens, or markers, on infected cells and help to activate another set of white cells, called B lymphocytes. The B cells then multiply and produce specific antibodies that bind to infected cells and to free organisms bearing the identified antigen, inactivating those cells and organisms or leading to their destruction (Redfield and Burke, 1988). The CD4 cell also orchestrates cell-mediated immunity: the

killing of infected cells by cytotoxic cells, such as T8 lymphocytes and white cells known as natural killer cells (Redfield and Burke, 1988). CD4 cells also influence macrophages, which engulf infected cells and foreign particles. Activated monocytes and macrophages secrete cytokines that modulate the activity of T and B cells. CD4 cells also secrete cytokines that stimulate the proliferation of T and B cells.

CD 4 cells are important in HIV infection because the clinical course of infection is mainly determined by the number of CD4 lymphocytes in the blood (McCutchan, 1990; Baltimore and Feinberg, 1989). Although the virus is found in other classes of immune cells, such as the macrophage (Haseltine and Wong-Staal, 1988), the HIV virus attaches directly to the CD 4 cell and destroys it (Bridge, 1987; Fauci, 1987). When the virus enters the CD 4 cell, an enzyme, reverse transcriptase, transcribes the genetic code on the RNA of the virus into DNA. They may or may not then be integrated into the host cell's chromosomes. Another way CD 4 cells are destroyed uses the body's normal mechanism for disposing of damaged blood cells. As the HIV virus circulates in the bloodstream, it damages cells with which it comes in contact. This causes the cells to clump together and form syncytia which are normally disposed of by the kidneys ( ). Most of the cell-associated

virus in the blood is contained within CD 4 + T cells (Baltimore and Feinberg, 1989).

CD8 cells

These cells "turn off" antibody-mediated immunity when the host has successfully defended itself against the invading pathogen, serving as counterregulatory immune modulators (Calabrese et al, 1987).

CD4/CD8 ratio

A proper balance between help (CD4) and suppression (CD8) appears necessary for the regulation of antibody synthesis (Calabrese et al, 1987). Patients with AIDS have an essentially nonfunctioning cellular immune system because of a selective quantitative defect in the helper/inducer subset of T cells, leading to reversal of the normal helper-to-suppressor ratio among peripheral blood lymphocytes (Lane et al, 1983).

B cells

B cells differentiate into two cell lineages. One group results in mature antibody-secreting plasma cells, while the other becomes memory B cells. The latter, upon a

second exposure to the same antigen rapidly differentiate into antigen-specific plasma cells (Calabrese et al, 1987).

Total lymphocytes - the total count of circulating lymphocytes.

Immunoglobulin M

IgM is capable of directly annihilating bacteria (CAlabrese et al, 1987). Levels of IgM increase in early HIV infection and then decrease (Zolla-Pazner et al, 1987).

Immunoglobulin A

IgA concentrates in body fluids, such as tears, saliva, and secretions of the respiratory and gastrointestinal tracts, functioning to protect those areas (Calabrese et al, 1987). These immunoglobulins are thought to act as a barrier, rather than actually killing pathogens. Levels of IgA increase consistently from individuals who are seronegative, to those who are seropositive, to those who have developed AIDS (Zolla-Pazner, 1987).

Immunoglobulin G

IgG enters most tissue spaces and functions by coating microorganisms to recognize pathogens. This enables macrophages to recognize, engulf, and destroy foreign antigens, such as bacteria (Calabrese et al, 1987). IgM

levels increase in early HIV infection, and then decrease (Zolla-Pazner et al, 1987).

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