## Module 2:

## PSYCHONEUROIMMUNOLOGY

The immune system is a complex system that fights to defend the body against ‘‘foreign’’ invaders, such as bacteria and viruses. When the body recognizes something as not-self within the body, it tries to eliminate it. This process initiated is called the immune response. Immunity is the ability of the body to fight against foreign invaders(antigen)

The antigens-: Any substance that can trigger an immune response is called an antigen. Includes viruses, bacteria, fungi, tissue of a transplanted organ, allergens, etc.

Antibodies- (immunoglobulins -Ig) protective protein produced by the immune system in response to a foreign substance antigen.

Parts of the immune system

1. White blood cells (WBC)
2. lymphatic system: Spleen, Bone marrow, and Thymus.

**WBC**- White blood cells also known as leukocytes are specialized blood cells mainly involved in immune response. White blood cells move through blood and tissue throughout your body, looking for foreign invaders (antigens) such as bacteria, viruses, parasites, and fungi. When they find them, they launch an immune attack.

WBC are of two types: lymphocytes and phagocytes

I. **Phagocytes** are scavengers that patrol the body and engulf and ingest antigens. They are not choosy. Macrophages and neutrophils are types of phagocytes. Phagocytes are involved in nonspecific immunity—they respond to any kind of antigen.
II. **Lymphocytes** attack specific antigens, are involved in producing antibodies, and provide cell-mediated and humoral immunity.

### LYMPHATIC SYSTEM

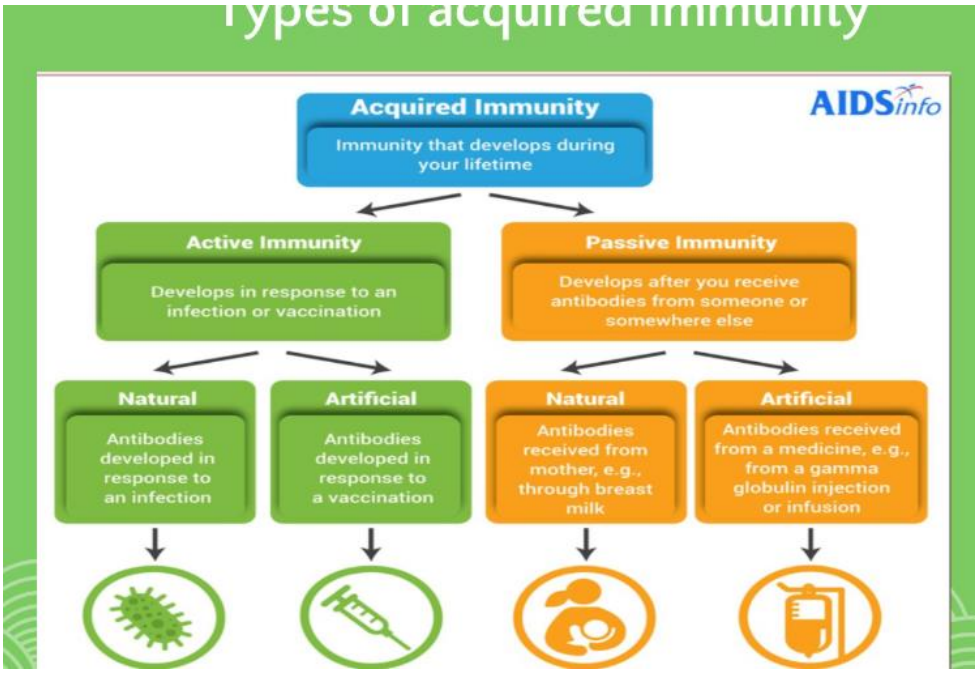
The organs of the immune system are located throughout the body. These organs are generally referred to as lymphatic or lymphoid organs because they have a primary role in the development and deployment of lymphocytes, specific white blood cells that are the key functionaries or ‘‘soldiers’’ in our body’s defense against invasion by foreign matter. The main lymphatic organs include the bone marrow, thymus, lymph nodes and vessels, and spleen.

**Lymph nodes and lymph vessels**- filter blood and store lymphocytes

**Spleen** -an organ in the upper left side of the person’s abdomen. It filters out antigens and serves as a home base for white blood cells. It also removes ineffective or worn-out red blood cells from the body.

**Bone marrow**- Lymphocytes originate in bone marrow, the soft tissue in the core of all bones in the body.

**Thymus,** which is an endocrine gland in t chest, produces white blood cells called T lymphocytes.




The immune system responds to antigens by attacking and eliminating invading substances and microorganisms to protect us from infection and disease. It does this by using white blood cells, including phagocytes and two types of lymphocytes: B cells, which produce antibodies, and T cells. These cells operate in different immune processes: antibody-mediated immunity uses B cells, cell-mediated immunity involves T cells, and nonspecific immunity uses phagocytes.

Stress, poor nutrition, and HIV infection impair the effectiveness of the immune system.

**Assessing immune functioning**

For Assessing Immune Functioning, many indicators of immune functioning have been used in research. Some approaches have been:

1. Assessing the functioning of immune cells
2. Assessing the production of antibodies to latent viruses
3. Assessing levels of immune system products, such as proinflammatory cytokines
4. Using indirect measures, such as wound healing

**1. Assessing the functioning of immune cells**

Assessing the functioning of immune cells involves examining the activation, proliferation(multiply), transformation, and cytotoxicity of cells.

One might assess the ability of lymphocytes to kill invading cells (lymphocyte cytotoxicity), the ability of lymphocytes to reproduce when artificially stimulated by a chemical (mitogen), or the ability of certain white blood cells to engulf foreign particles (phagocytotic activity).

**2. Assessing the production of antibodies to latent viruses**

Researchers also assess a person's ability to produce antibodies to a latent virus. All of us carry around viruses in our bodies that are inactive. Levels of antibodies to these latent viruses constitute a measure of how well the immune system is functioning. Producing antibodies to a vaccine is also a measure of immune functioning. When people have received a vaccination for a disorder, the degree to which the body produces antibodies to the vaccine is a sign of good immune functioning.

**3. Assessing levels of immune system products, such as proinflammatory cytokines**

Researchers can also measure immune-related products in the blood, such as proinflammatory cytokines. Cytokine levels are indicative of inflammatory activity and may increase in response to stress. For example, one study found elevations in IL-6, a proinflammatory cytokine, following exposure to laboratory stressors, especially among people who responded to those stressors with fear.

**4. Using indirect measures, such as wound healing**

Researchers also use wound healing or tape stripping as a method to study immune functioning. Using this method, researchers make a small puncture, usually in the forearm, and then examine how quickly the wound heals over and shrinks in people who are, for example, under stress or not. Wounds heal faster when the immune system is functioning vigorously. Psychological distress impairs the inflammatory response that initiates wound repair. Tape stripping, a related and less invasive procedure, involves applying an adhesive strip to the skin and pulling it off, and assessing how quickly skin barrier function recover. Although these methods only indirectly assess the functioning of the immune system, they are important because they involve a specific health outcome. For example, stress impairs wound repair due to surgery and thus may prolong the recovery period.

## PSYCHONEUROIMMUNOLOGY (PNI)

Psychoneuroimmunology refers to the interactions among behavioral, neuroendocrine, and immunological processes of adaptation. This field focuses on the relationships between psychosocial processes and the activities of the nervous, endocrine, and immune systems. These systems form a feedback loop: the nervous and endocrine systems send chemical messages in the form of neurotransmitters and hormones that increase or decrease immune function, and cells of the immune system produce chemicals, such as cytokines and ACTH, that feed information back to the brain. The brain appears to serve as a control center to maintain a balance in immune function since too little immune activity leaves the individual open to infection and too much activity may produce autoimmune diseases.

## Module 2: Psychoneuroimmunology

### Unit 2: Stress, Negative affect, Immune functioning, interpersonal relationships

The fundamental goal of the scientific field of health psychology is to define the psychological and social factors that influence health and disease. Psychoneuroimmunology is an interdisciplinary field that involves the investigation of the bidirectional relationships among the mind, brain, immune system, and health. Psychoneuroimmunology is based on the prediction that an individual's psychological state can influence their immune system via the nervous system. Psychoneuroimmunology refers to the interactions among behavioral, neuroendocrine, and immunological processes of adaptation. The term psychoneuroimmunology or PNI was coined by Robert Ader and Nicholas Cohen of the University of Rochester in the USA. They demonstrated the link using a paradigm called conditioned immunosuppression, based upon Pavlov's classical conditioning, they discovered that the immune system of rats could be conditioned to respond to external stimuli unrelated to immune function. The immune system is a major pathophysiological system; dysfunctions in this system can play a critical role in the etiology and progression of a variety of diseases, including infections, autoimmune diseases (such as rheumatoid arthritis), some forms of cancer, and cardiovascular disease, as well as mortality. The function of the immune system is to defend the body against invaders. Microbes (germs or microorganisms), cancer cells, and transplanted tissues or organs are all interpreted by the immune system as 'non-self' against which the body must be defended

**STRESS**

The condition of stress has two components: physical, involving direct material or bodily challenge, and psychological, involving how individuals perceive circumstances in their lives. These components can be examined in three ways. One approach focuses on the environment: stress is seen as a stimulus, as when we have a demanding job or experience severe pain from arthritis or a death in the family. Physically or psychologically challenging events or circumstances are called stressors. The second approach treats stress as a response, focusing on people's reactions to stressors. We see an example of this approach when people use the word stress to refer to their state of tension. Our responses can be psychological, such as your thought patterns and emotions when you ''feel nervous,'' and physiological, as when your heart pounds, your mouth goes dry, and you perspire. The psychological and physiological response to a stressor is called strain. The third approach describes stress as a process that includes stressors and strains, but adds an important dimension: the relationship between the person and environment. This process involves continuous interactions and adjustments—called transactions—with the person and environment each affecting and being affected by the other.

According to this view, stress is not just a stimulus or a response, but rather a process in which the person is an active agent who can influence the impact of a stressor through behavioral, cognitive, and emotional strategies. We will define stress as the circumstance in which transactions lead a person to perceive a discrepancy between the physical or psychological demands of a situation and the resources of his or her biological, psychological, or social systems. The stress response - we experience stress when two systems are activated, the first and easiest to activate is the sympathetic adrenal medullary (SAM) system; the second is the hypothalamic–pituitary–adrenal (HPA) axis.

The sympathetic adrenal medullary (SAM). When an individual is suddenly under threat or frightened, their brain instantly sends a message to the adrenal glands, which quickly release noradrenaline that in turn activates the internal organs. This is the basic ANS sympathetic division response to threat. However, at the same time, the adrenal medulla releases adrenaline, which is rapidly transported through the bloodstream in order to further prepare the body for its response. This system is known as the sympathetic adrenal medullary (SAM) system. Within moments adrenaline and noradrenaline have the entire body on alert, a response sometimes called the fight or flight response. As outlined earlier, as a result breathing quickens, the heart beats more rapidly and powerfully, the eyes dilate to allow more light in and the activity of the digestive system decreases to permit more blood to go to the muscles. This effect is both rapid and intense.

The hypothalamic–pituitary–adrenal (HPA) axis. In addition to the SAM response, when an individual experiences an unpleasant event in their environment that they perceive as stressful, the hypothalamus (the H in HPA) releases a chemical messenger called corticotrophin-releasing factor (CRF). Once released, CRF is transported in the blood supply to the pituitary gland (the P) where it stimulates the release of adrenocorticotrophic hormone (ACTH). Subsequently, the latter hormone travels through the circulatory system to the adrenal (the A) cortex where it stimulates the production of the glucocorticoid cortisol – known as the 'stress hormone'. One of the central functions of cortisol is to increase access to energy stores, increase protein and fat mobilization and decrease inflammation. Therefore, when an individual experiences stress, the release of cortisol triggers excess energy stored in the muscle and liver as glycogen to be liberated and broken down into glucose ready for utilization by the muscles and brain.

Many common stressors can adversely affect the immune system. Distress is a negative psychological response to goal threats that can involve a variety of affective and cognitive responses, including fear, hopelessness, a sense of being overwhelmed, sadness, anxiety, and frustration. A few models are now utilized to determine the impact of stressor exposure on immune activity. For example, acute stressors can be modeled in the laboratory with exposure to 20–30 minutes of stressful procedures, such as the performance of difficult tasks in front of an evaluative audience. Acute or short-term naturalistic stressors are time-limited circumstances that last days to weeks, such as taking school exams. Major life-change events are usually defined as exposure to a discrete event that disrupts one's normal life experience in a significant way but is time-limited, for example, marital separation or bereavement. Chronic stressors are prolonged, lasting weeks, months, or years, with a waxing and waning of impact e.g., caring for a family member with a chronic or life-threatening disease, or job loss, which can impact the immune system.

In animals, stressors such as electric shock, restraint, cold water swimming, maternal separation, and social defeat have been shown to cause both enumerative and functional alterations in the immune system. In humans, short-term stressors such as medical school examinations, major life-change events such as the death of a spouse or divorce, and chronic ongoing difficulties such as caregiving for a loved one with Alzheimer's disease have been found to be associated with changes in the number and proportion of various lymphocyte subsets.

Stressed individuals can engage in deleterious health behaviors, such as drug or alcohol use, reduced exercise, or altered nutrition that can affect their immune systems directly. A large amount of research effort has concentrated on exploring the extent to which psychological stress may influence different

aspects of the immune system. Two areas that have received particular attention are respiratory infectious illness and wound healing. Exposure to stressful circumstances and their psychological and physiological effects contribute to immune system dysfunction, over and above the effects of stress-related behavior change. Stressor exposure can also enhance certain immune functions but minimum amount of stress is important.

Stress and respiratory infectious illness

Over the last 25 years, Sheldon Cohen, a psychologist at Carnegie Mellon University in the USA, has explored the extent to which psychological and social factors influence susceptibility to infectious illnesses such as the common cold. Developed a unique prospective study design in which healthy participants are exposed to a virus that causes the common cold. Participants are then monitored following exposure in order to determine who develops a respiratory illness and reports cold-like symptoms. At baseline, participants also normally complete a range of psychological measures to assess their current level of perceived stress, their mood and any recent stressful life events. They demonstrated for the first time that increases in psychological stress are associated with increases in risk for developing a cold after exposure to a cold virus. If this is not impressive enough, they also demonstrated that this association was independent of the participants' baseline levels of specific antibodies, age, sex, education, allergic status, and body mass index, and the season of the year. In addition, they also explored whether the increased susceptibility was related to changes in stress-related health behaviors such as smoking, exercise, and diet. None of these variables explained the relationship. In a subsequent study, found two types of stressful life events were most strongly related to susceptibility. The first type of event was enduring (1 month or longer) interpersonal problems with family and friends. The second type was enduring problems associated with work (such as under- or unemployment). They also found that the longer the stressful event lasted, the greater the risk of developing an infectious illness. They found that regular exercise, non-smoking, and greater sleep efficacy (percent of the time in bed sleeping) were associated with lower susceptibility to developing a common cold. Earlier that cytokines are produced in response to infection. They are also believed to trigger symptoms associated with upper respiratory infections such as the common cold and the influenza virus (Cohen, 2005).

Therefore, using a more complex study design, Cohen, Doyle and Skoner (1999) investigated whether psychological stress influenced cytokine production in participants after receiving an influenza virus. Specifically, they tested whether stress had the capacity to interfere with the body's ability to regulate cytokine production. And found that stress short-circuited the body's ability to switch off the cytokine response. Taken together, these findings bring us to a surprising conclusion: psychological stress does not influence upper respiratory illness by suppressing the immune system. On the contrary, stress experienced over an extended period of time results in the immune system over-responding, which in turn activates and extends the symptoms of upper respiratory infections.

**Stress and wound healing**

In 1995, Janice Kiecolt-Glaser and colleagues from Ohio State University published a seminal study that provided evidence, for the first time, that psychological stress slowed wound healing. Using a punch biopsy, a 3.5 mm full-thickness wound was created on the non-dominant forearm, approximately 4 cm below the elbow, in each of the study participants. Levels of perceived stress were

then measured using questionnaires and the wound was photographed every day until it completely healed. A wound was considered fully healed when it no longer foamed after hydrogen peroxide was applied! Therefore, participants who were caring for a relative with Alzheimer's disease (high-stress group) were compared to control participants (low-stress group) matched for age and family income. The results of the study showed that complete wound healing took an average of 9 days or 24 percent longer in the caregiver group compared to the controls. Surprisingly, all students took longer to heal in the examination conditions compared to control conditions with complete healing taking an average of 3 days (or 40 percent) longer in the examination condition. Moreover, these results indicate that if patients are psychologically better prepared for surgery they are likely to experience significant health benefits.

## STRESS AND IMMUNITY IN HUMANS

Different kinds of stressors create different demands on the body, so they show different effects on the immune system. Two basic principles are important for understanding the relationship between stress and immunity. The first is that different kinds of stressors require different kinds of defense, and so a particular immune response may be favored over another in response to certain stressors. For example, short-term stressors raise the risk of injury, and so immune system changes involved in wound repair are very likely in response to short-term stress. A second important principle is that a maximally efficient immune response to any situation entails costs, and so some aspects of immunity may be adaptively suppressed as others are actively engaged. Human beings evolved so that, in response to sudden stress, changes in the immune system could take place quickly, leading to wound repair and infection prevention. Thus, short-term stressors (of a few minutes duration) elicit immune responses that anticipate the risk of injury and possible entry of infectious agents into the bloodstream. Short-term stress leads to rapid increases in certain immune cells as well as an enhanced response to vaccination. In contrast, specific immunity decreases in response to acute short-term stressors.

Specific immunity is slow to develop, so specific immunity would be of little if any help in combating short-term stressors. Thus, immediate short-term stressors produce a pattern of immune responses involving the up-regulation of natural immunity accompanied by the down-regulation of specific immunity. Brief stressors of several days' duration, such as preparing for examinations, show a different pattern. Rather than altering the number or percentage of cells in the blood, brief stressors lead to changes in cytokine production, indicating a shift away from cellular immunity and toward humoral immunity. Chronically stressful events, such as being unemployed or engaging in long-term caregiving, are linked to adverse effects on almost all functional measures of the immune system. These effects are stronger among people with preexisting vulnerabilities, such as old age or disease. Chronic inflammation, which can occur in response to chronically stressful conditions contributes to a broad range of disorders, including heart disease and declines in cognitive performance. Thus, different types of stressful events (short-term versus a few days versus long-term) make different demands on the body that are reflected in different patterns of immune activity. The body's stress systems appear to partially regulate these effects. Stress engages the sympathetic nervous system and the HPA axis, both of which influence immune functioning. Sympathetic activation in response to stress has the immediate effects of increasing immune activity, especially natural killer cell activity. Stress-related changes in hypothalamic adrenocortical functioning have immunosuppressive effects. That is, activation of the HPA axis leads to the release of glucocorticoids such as cortisol; cortisol

reduces the number of white blood cells, affects the functioning of lymphocytes, and reduces the release of cytokines, which can reduce the ability of these substances to signal and communicate with other aspects of the immune system.

## HEALTH RISKS

Both children and adults under stress show increased vulnerability to infectious diseases, including colds, flu, herpes virus infections such as cold sores or genital lesions, chicken pox, mononucleosis, and Epstein-Barr virus. Among people who are already ill, stress predicts more severe illness and higher production of cytokines. Autoimmune disorders are also affected by stress.

## NEGATIVE AFFECT AND IMMUNE FUNCTIONING

Research has focused on the capacity of psychological factors to change immune functioning. In particular, it has examined the role of mood. Studies indicate that positive mood is associated with better immune functioning that negative mood is associated with poorer functioning and that humor appears to be specifically beneficial. The affective response may play an important role in determining the immunological changes associated with exposure to a stressor. Davidson has shown that greater relative right prefrontal activation is associated with less positive and more negative trait affect. Major depression is associated with immune alterations, including functional changes that are similar to those observed with naturalistic stressors. Depression is associated with reliable increases in certain immune subsets (e.g., neutrophils) and decreases in others (B and T cells). Depressed individuals most vulnerable to immune suppression appear to be those with more severe depression, older age, and those who also have a sleep disorder or alcoholism

Recent evidence suggests immune enhancement can also occur with depression. In initial studies by Maes and his colleagues, patients with depressive symptoms or syndromal depression showed evidence of increased levels of proinflammatory cytokines, although these findings are not always consistent. One of the most provocative aspects of the research on depression and proinflammatory cytokines is the hypothesis that these cytokines may play an etiologic role in depression.

Four sets of findings support this possibility. First, studies, as described above, demonstrate a link between a diagnosis of depression and increased levels of these cytokines. Second, injections of proinflammatory cytokines in humans can induce depression-like symptoms, including dysphoria, anhedonia, helplessness, fatigue, and apathy, which regress when treatment has ended. Third, patients with inflammatory diseases that are often accompanied by elevated levels of proinflammatory cytokines have an increased risk for depression. And finally, animals injected with these cytokines either peripherally or centrally show an increase in a number of behaviors that overlap with depression.

## INTERPERSONAL RELATIONSHIPS

The sources of stress may change as people develop, but stress can occur at any time throughout life. Sometimes the source of stress is within the person. Illness is one-way stress arises from within the individual. Being ill creates physical and psychological demands on the person, and the degree of stress these demands produce depends on the seriousness of the illness and the age of the individual, among other things. Why is the person’s age important? For one thing, the ability of the body to fight disease normally improves in childhood and declines in old age. Another reason is that the meaning of a serious illness for the individual changes with age. For adults, stress appraisals of an illness typically include

both current difficulties and concerns for the future, such as whether they may be disabled or may die. But because young children have a limited understanding of disease and death, their appraisal of stress that arises from their illness is likely to focus on current, rather than future, concerns—such as how well they feel at the moment and whether their activities are impaired

Another way stress arises within the person is through the appraisal of opposing motivational forces when a state of conflict exists. Suppose you are registering for next semester and find that two courses you need meet at the same time. You can take only one. Which will you choose? You have a conflict—you are being pushed and pulled in two directions. Many conflicts are more momentous than this one. We may need to choose between two or more job offers, or different medical treatments, or expensive purchases. The pushes and pulls of conflict produce opposing tendencies: approach and avoidance. But conflicts can be more complicated, having several alternatives, with many attractive and unattractive features. In general, people find conflict stressful when choices involve many features, when opposing motivational forces have fairly equal strength, and when the ‘‘wrong’’ choice can lead to very negative and permanent consequences. These conditions often apply when people face major decisions about their health.

**Table 3.3** *Three Main Types of Conflict*

| Type | Definition/Example/Effect |
|---|---|
| Approach/approach | Choice involves two appealing goals that are incompatible. For example, individuals trying to lose weight to improve their health or appearance experience frequent conflicts when delicious, fattening foods are available. Although people generally resolve an approach/approach conflict fairly easily, the more important the decision is to them, the greater the stress it is likely to produce. |
| Avoidance/avoidance | Choice between two undesirable situations. For example, patients with serious illnesses may be faced with a choice between two treatments that will control or cure the disease, but have very undesirable side effects. People in avoidance/avoidance conflicts usually try to postpone or escape from the decision; when this is not possible, people often vacillate between the two alternatives, changing their minds repeatedly, or get someone else to make the decision for them. People generally find avoidance/avoidance conflicts difficult to resolve and very stressful. |
| Approach/avoidance | A single goal or situation has attractive and unattractive features. This type of conflict can be stressful and difficult to resolve. Consider, for instance, individuals who smoke cigarettes and want to quit. They may be torn between wanting to improve their health and wanting to avoid the weight gain and cravings they believe will occur. |

Some of our most common and significant stressors arise from motives or goals, especially motives about social interactions and relationships with other people. Social motives include the need to be connected to and valued by others, and concerns about achievement and status. As a result, experiences of rejection, isolation, conflict with others, competition, failure, and disrespect are central sources of stress. For example, the threat of being rejected or evaluated negatively by others can evoke large stress responses, including an increase in blood pressure, cortisol, and other stress hormones. Also, interacting with other people who are perceived as higher in status, competing with others, and making an active effort to influence or control other people also evoke physiological stress responses.

Our closest relationships can be major sources of stress. Families provide great comfort but can be sources of tension and conflict, as well. A new child in the family is typically a joyful event, but it also brings stress. —particularly to the mother, of course, during pregnancy, and after the birth. But an addition to the family is stressful to other family members, too. For instance, the father may worry about the health of his wife and baby or fear that his relationship with his wife may deteriorate, and both parents may feel the need to earn more money. The arrival of a new baby can also be stressful for other children in the family. An important factor in parental stress relates to the child’s emerging personality. Each baby has personality dispositions, which are called temperaments

Conflict in marriage is nearly universal, but when it becomes frequent and severe, it is a major source of stress with important consequences for health. When couples discuss issues that are sources of disagreement or conflict, such as household finances or chores, they show increases in blood pressure, cortisol and other stress hormones, and other physiological stress responses These stress responses are especially evident in couples who are experiencing chronic marital strain and in those whose disagreements include more hostile comments toward each other. Separated and divorced people have the highest rates of both acute and chronic medical problems even when many demographic factors are controlled for. In addition, these people also have higher rates of mortality from infectious diseases such as pneumonia. In one study they assessed the associations between marital status and marital quality and markers of immune function. Their results showed that poor marital quality was associated with both depression and a poorer immune response. In addition, they reported that women who had been recently separated showed poorer immune responses. Also, the death of loved ones, family illness, and disability can cause stress. hen children have a serious chronic illness, their families must adapt to unique and long-term stress, having a physically ill or disabled adult in the family restricts the family's time and freedom, and produces very important changes in interpersonal relationships.

Contacts with people outside the family provide many sources of stress. For instance, children experience stress at school and in competitive events, such as in sports and talent performances. Much of the stress adults experience is associated with their jobs and the environmental conditions where they live. However, many people also experience chronic stress caused by factors such as poverty, unemployment or work load. Almost all people at some time in their lives experience stress that relates to their occupations. What factors make jobs stressful? The demands of the task can produce stress in two ways. First, the workload may be too high. Some people work very hard for long hours over long periods of time because they feel required to do so—for example, if they need the money or think their bosses would be unhappy if they did not. Studies have found that excessive workloads are associated with increased rates of accidents and health problems.

Jobs that involve responsibility for people's lives can be very stressful. Medical personnel have heavy workloads and must deal with life-or-death situations frequently. Making a mistake can have dire consequences. In an intensive care unit of a hospital, emergency situations are common; decisions must be made instantly and carried out immediately and accurately

**The physical environment of the job**.

Stress increases when the job involves extreme levels of noise, temperature, humidity, or illumination

Perceived insufficient control over aspects of the job. People experience stress when they have little opportunity to learn new skills and make decisions on their own.

Poor interpersonal relationships. People's job stress increases when a co-worker or customer is socially abrasive or treats them unfairly.

Perceived inadequate recognition or advancement. Workers feel stress when they feel they are treated unfairly, as when they do not get the recognition or promotions, they believe they deserve.

Job loss and insecurity. People experience stress when they lose their jobs or think they are likely to be fired or laid off can lead to stress.

# HEALTH PSYCHOLOGY

## MODULE 2: PSYCHONEUROIMMUNOLOGY

### STRESS AND THE IMMUNE SYSTEM

A large literature indicates that stress can impact the immune system. The literature often uses the term stress in a vague and inconsistent way, sometimes referring to stress as a stimulus, sometimes as a psychological response, and sometimes as the physiological response to difficult circumstances. Several more specific terms are preferable. Stressors or stressful life experiences are circumstances that threaten a major goal. Stress can have a significant impact on the immune system. When you experience stress, whether it is acute (short-term) or chronic (long-term), your body undergoes a series of physiological changes that can affect the functioning of your immune system.

1. **Impaired immune response**: Prolonged stress can suppress immune function, making you more susceptible to infections, viruses, and other diseases. It can also slow down the healing process and increase the risk of developing chronic conditions.
2. **Increased susceptibility to illness**: When the immune system is compromised due to stress, you may be more vulnerable to various health problems, including the common cold, flu, allergies, and autoimmune disorders. Stress can also exacerbate existing conditions, making symptoms worse.

#### Stress Moderators

Coping with stressful situations that exceed one's abilities is one of the greatest challenges of life. People with many resources, such as money or social support, may find a stressful experience to be less so. Others, without resources or coping skills, cope poorly. We term these factors stress moderators because they modify how stress is experienced and the effects it has. Stress moderators are the internal elements of skills, behavioral patterns, qualities, and traits that reduce stress levels. Moderators of the stress experience may have an impact on stress itself, on the relationship between stress and psychological responses, on the relationship between stress and illness, and on the degree to which a stressful experience intrudes into other aspects of life. Social support, mind-body techniques, coping strategies, healthy lifestyle.

### RESILIENCE AND IMMUNE FUNCTIONING

Psychological resources such as these **not only enable people to confront and cope with stressors.** They also help **them bounce back** from bad experiences and adapt flexibly to the changing demands of stressful situations. A sense of coherence about one's life, **a sense of purpose or meaning in one's life**, a sense of humor, **trust in others**, a sense that **life is worth living**, and **religious beliefs** are also resources that promote resilience and effective coping. In addition to these personality resources, taking opportunities for rest, relaxation, and renewal help people cope more effectively with stressors. **Being able to feel positive emotions**, even when going through intense stressors, is a coping method that resilient people draw on.

The American Psychological Association (2014) has produced a list of 10 ways to build resilience:

- **Make connections**: building relationships, accepting and giving help and support.

- **Avoid seeing crises as insurmountable problems**: change how you interpret and respond to difficult events.
- **Accept that change is part of living**: this includes accepting circumstances that cannot be changed.
- **Move toward your goals**: develop realistic goals and take steps to move towards them.
- **Take decisive actions**: act on difficult situations rather than detaching from them or wishing they will go away.
- **Look for opportunities for self-discovery**: try to learn from difficult experiences.
- **Nurture a positive view of yourself**: develop confidence in your abilities to solve problems and trust your instincts.
- **Keep things in perspective**: avoid blowing problems out of proportion.
- **Maintain a hopeful outlook**: be optimistic.
- **Take care of yourself**: for example, engage in activities you enjoy, exercise.

**OPTIMISM**

An optimistic nature can help people cope more effectively with stress and reduce their risk for illness. **M. F. Scheier** and colleagues developed a measure of dispositional optimism that identifies generalized positive expectations about the future. The Life Orientation Test (LOT-R). Optimists have better physiological stress profiles on indicators such as cortisol, blood pressure, and inflammation. Optimism also promotes active and persistent coping efforts, which **improves long-term prospects for psychological and physical health.** Optimism fosters a **sense of personal control**, which has beneficial effects on physical functioning. Optimists use **problem-focused coping**, seek **social support from others**, and **emphasize the positive aspects** of stressful situations.

Optimism is usually beneficial for coping. But because optimists are persistent in pursuing their goals, they sometimes experience short-term physiological costs. **When optimists**' expectations are not met, they may feel stressed, and compromised immune functioning may be a short-term consequence. Overall, though, optimism is a potent and valuable resource.

**S. C. Segerstrom and colleagues** found that optimism and active coping strategies protect against stress. In this study, 90 first-year law students, tested at the beginning of law school and again halfway through the first semester, completed questionnaires measuring how they coped with the stress of law school, and they had blood drawn for an assessment of immune measures. The optimistic law students and students who used fewer avoidant coping methods showed less distress across the quarter. Pessimism, avoidance coping, and mood disturbance were tied to lower **natural killer cell** cytotoxicity and fewer T cells, suggesting that optimism and coping can be important influences on stress-related distress and immune changes.

**SELF EFFICACY**

Self-efficacy can potentially act as a stress moderator on immune functioning. Chronic stress has been linked to negative effects on the immune system, increasing susceptibility to illnesses

and impairing immune responses. Here's how self-efficacy can play a role in moderating the impact of stress on immune functioning:

1. **Stress Perception:** Individuals with high self-efficacy tend to perceive stressors as more manageable and within their control.

This positive mindset can influence their perception of stress and reduce its impact on the body. By perceiving stress as less threatening, they may experience lower levels of stress-induced physiological responses that could otherwise compromise immune function.

2. **Stress Coping**: Self-efficacious individuals are more likely to engage in active coping strategies when faced with stress.

These strategies may include problem-solving, seeking social support, and addressing stressors proactively. By actively managing stress, they can reduce its negative impact on immune functioning.

3. Psychological Well-being: Self-efficacy is closely related to psychological well-being, including lower levels of anxiety and depression. High self-efficacy can buffer the detrimental effects of stress on mental health, which, in turn, can have a positive impact on immune functioning.

4. **Lifestyle Behaviors**: Self-efficacious individuals are more likely to engage in healthy lifestyle behaviors, such as regular exercise, proper nutrition, and adequate sleep. These behaviors have been shown to support immune function and counteract the negative effects of stress on the immune system.

By maintaining a healthy lifestyle, individuals with high self-efficacy can potentially mitigate the impact of stress on immune functioning.

Overall, self-efficacy can potentially act as a stress moderator on immune functioning by influencing stress perception, coping strategies, psychological well-being, and lifestyle behaviors. However, further research is needed to fully understand the mechanisms underlying this relationship.

**PSYCHOLOGICAL CONTROL-INTERVENTION**

Psychological control is the belief that one can determine one's own behavior, influence one's environment, and bring about desired outcomes. The belief that one can exert control over stressful events has long been known to help people cope with stress. So powerful are the effects of psychological control that **they are the basis for interventions to promote good health habits** and **to help people cope with stressful events**, such as surgery and noxious medical procedures. People going through unpleasant medical procedures, such as gastro-endoscopic exams childbirth, and chemotherapy, have all benefitted from **control-enhancing interventions.** These interventions **use information**, **relaxation**, and **cognitive-behavioral techniques**, such as learning to think differently about the unpleasant sensations of a procedure, **to reduce anxiety**, **improve coping**, and **promote recovery**.

## COPING AND IMMUNE FUNCTIONING

Coping resources affect the relationship between stress and immune functioning. Protective Effects of Psychosocial Resources Social support can buffer people against adverse immune changes in response to stress. For example, in a study of breast cancer patients, **S. M. Levy and colleagues** (1990) found that receiving **emotional support** from one's spouse or partner or from a physician was associated with high NK cell activity (natural killer cells). Other resources, **including finances**, can also limit deterioration in immune functioning. To summarize, coping resources are important because they **help people manage the demands of daily stressful events** with less emotional distress, fewer health risks, better health habits, and a higher quality of life.

## PERSONAL CONTROL/BENEFIT FINDINGS

People who regard stressors they are undergoing as uncontrollable are more likely to show adverse immune effects. For example, a study of women with rheumatoid arthritis found that those who perceived themselves as unable to cope with stressful events had lower levels of circulating **B cells**. Finding benefits in stressful events may improve immune functioning or at least undercut the potential damage that stress may otherwise do. **J. E. Bower and colleagues** found that women who wrote about positive changes in important personal goals over a monthlong period showed increases in natural killer cell cytotoxicity. Potentially, then, **prioritizing goals** and **emphasizing relationships**, **personal growth**, and **meaning in lif**e may have beneficial biological effects on immune functioning.

## INTERVENTIONS TO IMPROVE IMMUNE FUNCTIONING

- **Relaxation:**

Relaxation therapies include deep breathing, progressive muscle relaxation training, guided imagery, transcendental meditation, yoga, and self-hypnosis. These techniques can reduce heart rate, muscle tension, blood pressure, inflammatory activity, lipid levels, anxiety, and tension, among other physical and psychological benefits. Relaxation may mute the effects of stress on the immune system. In a study with elderly adults (a group at risk for illness because of age-related declines in immune functioning), participants were assigned to relaxation training, social contact, or no intervention. Participants in the relaxation condition had significantly higher levels of natural killer (NK) cell activity. This pattern suggests some enhancement of cellular immunity associated with the relaxation intervention.

Even **5–10 minutes of deep breathing** and **progressive muscle relaxation** can be beneficial. Yoga may have health benefits. One study found that people who regularly practiced yoga experienced **more positive emotions** and showed **lower inflammatory responses** to stress than those who were new to the practice. Yoga, then, may ameliorate the burden that stresses places on an individual. Training in **mindfulness meditation** can affect immune functioning. A study in which older adults were trained in tai chi chih (TCC) showed reduced intensity and severity of herpes zoster (shingles), suggesting that this may be a useful intervention as well. Overall, the evidence suggests that interventions can have significant effects on the immune system and on health outcomes. Stress management interventions including relaxation show the most consistent benefits.

Certainly, in addition to relaxation techniques, here are some other interventions that can help improve immune functioning:

- ✓ Balanced Nutrition: Consuming a balanced and nutrient-rich diet is crucial for optimal immune function. Focus on incorporating immune-boosting foods such as fruits, vegetables, whole grains, lean proteins, nuts, and seeds. These foods provide essential vitamins, minerals, and antioxidants that support immune health.
- ✓ Stress Reduction Techniques: These include mindfulness meditation, journaling, engaging in hobbies, spending time in nature, practicing gratitude, and participating in activities that bring joy and relaxation.
- ✓ Having proper health supplements

Remember that these interventions are meant to support overall immune health and should be practiced in conjunction with a healthy lifestyle. If you have specific health concerns or conditions, it's always advisable to consult with a healthcare professional for personalized guidance.

# AUTO IMMUNODEFICIENCY SYNDROME

**AIDS**: stands for acute immunodeficiency syndrome. Acquired means you can get infected by it. Immune deficiency means weakness in the body's system that fights diseases. Syndrome means a group of health problems that make up a disease. AIDS is caused by a virus called HIV (a retrovirus that infects and attacks the immune system of humans). Two types of HIV: HIV I & HIV II. HIV II is less easily transmitted. Two types of anti-body tests: ELISA & Western Blot ( saliva & urine).

## AIDS (acquired immunodeficiency syndrome)

**AIDS (acquired immunodeficiency syndrome)** is a serious medical condition caused by the human immunodeficiency virus (HIV). HIV attacks the immune system, specifically targeting CD4 cells (a type of white blood cell), which play a crucial role in fighting off infections and diseases. When a person becomes infected with HIV, their immune system gradually becomes weaker, making them more susceptible to opportunistic infections and certain types of cancers. If left untreated, HIV infection progresses to AIDS, which is the final stage of the disease. A person can contract HIV through the exchange of certain body fluids, including blood, semen, vaginal fluids, and breast milk.

**Acquired immunodeficiency syndrome**—AIDS—is a very different high-mortality chronic illness.

First, AIDS is a new disease and was virtually unknown before 1980.

Second, it is an infectious disease that is caused by a virus (HIV) and is spread through the shared contact of blood and semen.

Third, although the death rate from AIDS is fairly low in developed countries, it is a worldwide epidemic with 2.7 million new infections and 2 million deaths annually (UNAIDS, 2009).

Worldwide, most newly infected people are heterosexuals with high rates of unsafe sex in developing nations, and they will probably die of AIDS.

## HIV (Human Immunodeficiency Virus)

HIV (Human Immunodeficiency Virus) is a retrovirus that infects and attacks the immune system of humans.

The most common modes of HIV transmission are:

1. Unprotected sexual intercourse with an infected partner.
2. Sharing needles or syringes contaminated with HIV-infected blood.
3. Transmission from an HIV-positive mother to her child during pregnancy, childbirth, or breastfeeding.

It's important to note that HIV is not spread through casual contact such as hugging, shaking hands, or sharing utensils. The symptoms of HIV can vary, and some individuals may not experience any symptoms for years after infection. However, common signs and symptoms may include fever, fatigue, swollen lymph nodes, weight loss, recurring infections, and opportunistic illnesses.

## HIV transmission

HIV, the virus that causes AIDS, can be transmitted through certain body fluids, including:

1. **Sexual Transmission:** The most common mode of HIV transmission is through sexual intercourse, especially unprotected vaginal, anal, or oral sex with an infected person. The virus can enter the bloodstream through cuts, sores, or direct contact with mucous membranes in the genital, rectal, or oral areas.
2. **Blood Transmission**: HIV can be spread through direct contact with infected blood. This can occur through sharing needles or syringes contaminated with HIV-infected blood, blood transfusions with

unscreened blood (rare in countries with strict blood screening protocols), or accidental needle-stick injuries among healthcare workers.

3. **Mother-to-Child Transmission**: An HIV-positive mother can transmit the virus to her child during pregnancy, childbirth, or breastfeeding. However, with proper medical interventions such as antiretroviral therapy (ART) during pregnancy and delivery, as well as formula feeding instead of breastfeeding, the risk of transmission can be significantly reduced.

4. **Occupational Exposure**: Healthcare workers may be at risk of HIV transmission if they are accidentally exposed to infected blood through needle-stick injuries or other sharps injuries in healthcare settings.

It's important to note that HIV is not transmitted through casual contact such as hugging, kissing, shaking hands, sharing utensils, or insect bites.

**From HIV Infection to AIDS**

When HIV infection occurs, several years may pass before the person's immune function is impaired—mainly from reduced numbers of helper T cells—and symptoms appear. During the period before symptoms emerge, the virus appears to hide in the person's lymph tissue, multiplying there and battling the immune system. The diagnosis of AIDS is made only once the victim's condition has reached a certain criterion. Several years after the infection, an untreated victim's immune system falters, usually producing a variety of recurrent symptoms, such as spiking fever, night sweats, diarrhea, fatigue, and swollen lymph glands. If the diagnosis comes after symptoms appear, the immune system is already weakened and struggling to fight opportunistic diseases, which often can be treated with medication.

HIV (Human Immunodeficiency Virus) leads to AIDS (Acquired Immunodeficiency Syndrome) through a progressive deterioration of the immune system. Here's an overview of the process:

1. **HIV Infection**: When a person becomes infected with HIV, the virus targets and invades specific immune cells called CD4 T-cells, which play a crucial role in coordinating the immune response. HIV enters these cells, replicates, and gradually destroys them.

2. **Initial Acute Infection:** After HIV enters the body, individuals may experience a flu-like illness known as acute HIV infection. During this stage, the virus replicates rapidly, and the immune system mounts an initial response to control the infection. However, many people may not experience any noticeable symptoms during this stage.

3. **Clinical Latency:** Following the acute infection, the virus enters a phase called clinical latency or chronic asymptomatic phase. During this period, HIV continues to replicate at a low level, but there may be few or no symptoms. However, the virus is still actively damaging the immune system, particularly CD4 T-cells.

4. **Progression to AIDS:** If left untreated, HIV gradually weakens the immune system over time. The number of CD4 T-cells declines, and the immune system becomes increasingly compromised. As the CD4 cell count drops below a certain threshold (usually below 200 cells per microliter of blood), the person is considered to have progressed to AIDS.

5. **Opportunistic Infections and AIDS-Defining Conditions**: With a severely weakened immune system, individuals with AIDS become vulnerable to opportunistic infections, which are caused by organisms that usually do not cause illness in people with a healthy immune system. These infections can include pneumonia, tuberculosis, fungal infections, and certain types of cancers. The occurrence of specific opportunistic infections or AIDS-defining conditions helps to diagnose AIDS.

6. **AIDS-related Complications:** In addition to opportunistic infections, people with AIDS may also experience other complications related to their weakened immune system. These can include neurological disorders, wasting syndrome (severe weight loss), and various HIV-related malignancies.

It's important to note that not everyone with HIV infection progresses to AIDS. With early diagnosis and access to antiretroviral therapy (ART), which suppresses the replication of HIV, the progression to AIDS can be significantly slowed or even halted.

**Opportunistic infections**

**Opportunistic infections** are infections caused by organisms that typically do not cause disease in individuals with a healthy immune system. However, in people with weakened immune systems, such as those with AIDS (Acquired Immunodeficiency Syndrome), these infections can take advantage of the compromised immune system and cause severe illness. Due to the progressive destruction of CD4 cells (a type of white blood cell involved in immune response) by the human immunodeficiency virus (HIV), people with AIDS become more susceptible to opportunistic infections. These infections can be caused by various bacteria, viruses, fungi, and parasites.

Some common opportunistic infections associated with AIDS include:

1. **Pneumocystis pneumonia (PCP):** This is a severe lung infection caused by the fungus Pneumocystis jirovecii. It can cause cough, fever, difficulty breathing, and chest pain.
2. **Tuberculosis (TB):** HIV weakens the immune system's ability to control TB infection. TB can affect the lungs but may also spread to other organs.
3. **Candidiasis:** This fungal infection caused by Candida species can affect the mouth, throat (thrush), esophagus, and genital area. It can cause white patches, sores, and discomfort.
4. **Cytomegalovirus (CMV) infection:** CMV is a common virus that can cause eye infections, pneumonia, gastrointestinal issues, and neurological complications.
5. **Toxoplasmosis**: This infection is caused by the parasite Toxoplasma gondii and can affect the brain, causing symptoms such as confusion, seizures, and headaches.
6. **Cryptococcal meningitis**: It is a fungal infection that affects the membranes surrounding the brain and spinal cord, leading to symptoms like severe headaches, fever, neck stiffness, and altered mental status.
7. **Kaposi's sarcoma:** This is a type of cancer caused by a virus called human herpesvirus 8 (HHV-8). It presents as skin lesions, usually appearing as purplish-red patches or nodules.
8. **Mycobacterium avium complex (MAC) infection**: This bacterial infection affects multiple organs, including the lungs, lymph nodes, and intestines. It can cause fever, fatigue, weight loss, and diarrhea.

**Preventing and managing opportunistic infections** in people with AIDS involves a combination of strategies, including:

1. Antiretroviral therapy (ART): Taking prescribed antiretroviral medications to suppress HIV replication and improve immune function.
2. Prophylactic Medications: Certain medications, such as trimethoprim-sulfamethoxazole (TMP-SMX), can be prescribed to prevent certain opportunistic infections.
3. Vaccinations: Staying up-to-date with recommended vaccinations, such as those for pneumococcal disease and influenza, to prevent vaccine-preventable infections.
4. Regular Medical Care: Seeking regular medical follow-up and monitoring to detect and manage infections early.
5. Good Hygiene Practices: Practicing good personal hygiene, including handwashing, to reduce the risk of infections.

**Age, Gender, and Sociocultural Factors in AIDS**

Worldwide, there are over 33 million people living with HIV/AIDS, and over 16% of newly infected individuals per year are children**.** In the United States, the number of new HIV diagnoses annually is much higher among 25- to 55-yearold adults than other age groups and about three times higher in men than women; males have constituted over 80% of all AIDS cases since the epidemic began**.** American death rate data reveal sociocultural differences: for males and females, AIDS death rates are far higher for Blacks and Hispanics than for Whites and Native Americans, whose rates are higher than for Asian Americans.

**HIV and INDIA**

HIV/AIDS is a significant public health concern in India. The country has a large population and diverse social, cultural, and economic factors that influence the spread and impact of the disease. Here are some key points about HIV/AIDS in India:

Prevalence: According to the National AIDS Control Organization (NACO) of India, the estimated number of people living with HIV in India in 2020 was around 2.35 million. However, it's worth noting that prevalence rates vary across different regions of the country.

High-Risk Groups: Certain populations are considered at higher risk of HIV infection in India, including female sex workers, men who have sex with men, transgender individuals, people who inject drugs, and migrant populations. Efforts to address HIV/AIDS in India often focus on these key populations.

Challenges: Despite progress, challenges remain in the fight against HIV/AIDS in India. These include stigma and discrimination, limited awareness in certain communities, barriers to accessing healthcare services, and the need for sustained funding and resources.

While Kerala has a relatively lower HIV prevalence compared to some other states in India. According to the data available up to September 2021, Kerala had an estimated HIV prevalence rate of 0.09% among the adult population (15-49 years), which is comparatively lower than the national average in India. However, it's important to note that prevalence rates may vary within different districts and population groups within the state.

**Medical Treatment for People with HIV/AIDS**

The main treatment for AIDS today uses drugs called antiretroviral agents, which suppress HIV reproduction and reduce viral load. When two or more of these agents are combined, the treatment is extremely effective and called highly active antiretroviral therapy (HAART). Treatment with HAART has had dramatic effects: the incidence of opportunistic diseases is much lower in patients after using HAART than before. And in some patients, HIV is no longer detected in their blood tests. But there are several problems with this treatment.

First, it is very expensive.

Second, although its use in treating HIV is widespread in high-income nations, only about 42% of people who need HAART in low- and middle-income countries are getting it.

Third, the HAART regimen is complex and rigorous: it often has the person take medication several times a day and requires strict adherence—some experts claim that 95% compliance is needed or its value in suppressing the virus diminishes.

Fourth, many people who use HAART do not adhere to the regimen well enough because of its complexity and side effects and because of emotional difficulties, drug abuse, poor social support, or cognitive difficulties that sometimes result from HIV infection.

**THE PSYCHOSOCIAL IMPACT OF AIDS**

Depression commonly accompanies an HIV diagnosis, especially for people with little social support, who feel stigmatized by their sexual preference or race, who engage in avoidant coping, and/or who have more

severe HIV symptoms. Depression can reduce receptivity to interventions, as well as lowering quality of life. Interventions that reduce depression are, thus, useful in the fight against AIDS.

Many people who are HIV seropositive have the additional burden of bereavement. Bereavement itself can increase the likelihood that the disease will progress, and so bereavement counseling can be important for reducing risk. Thoughts of suicide are common especially among socially isolated infected people. The majority of people who are HIV seropositive make positive changes in their health behaviors almost immediately after diagnosis, including changing diet in a healthier direction, getting more exercise, quitting or reducing smoking, and reducing or eliminating drug use. Coping skills training and the practice of meditation may also improve adjustment to the disease. Many of these changes also improve psychological well-being, and they may affect the course of infection as well.

**Disclosure**

Not disclosing HIV status or simply lying about risk factors, such as the number of partners one has had, is a major barrier to controlling the spread of HIV infection. Moreover, those less likely to disclose their HIV + status to sex partners also are less likely to use condoms during intercourse. People with strong social support networks are more likely to disclose and are, in turn, more likely to receive social support. Thus, disclosure appears to have psychosocial benefits. In addition, disclosure can have health benefits. In one study, those who had disclosed their HIV + status to their friends had significantly higher levels of CD4 and helper cells than those who had not. Whether to disclose HIV-seropositive status is influenced by cultural factors. In the case of HIV, however, there may be a desire to protect family members, which acts as a barrier to disclosure. Nondisclosure may mean that these young men are unable to get the social support they need from their families. In many countries, HIV remains a highly stigmatizing disease, which impedes disclosure as well.

**Interventions to Reduce the Spread of HIV Infection**

Interventions to reduce risk-related behavior loom large as the best way to control the spread of HIV infection. Th ese interventions center around getting tested, refraining from high-risk sex, using a condom, and not sharing needles.

1. Education

Most interventions begin by educating the target population about risky activity, providing information about HIV infection and modes of transmission. Studies suggest a high degree of “magical thinking” about HIV, with people overreacting to casual contact with HIV + individuals but underreacting to their own health risks resulting from casual sex and failure to use a condom. Beliefs that HIV infection is now a manageable disease and that people under treatment will not pass on an infection have contributed to a resurgence of new infections. A review of 27 published studies that provided HIV counseling and testing information found that this type of education was an eff ective means of secondary prevention for HIV + individuals, reducing behaviors that might infect others. However, it was not an effective primary prevention strategy for uninfected people. Many women lack knowledge regarding the transmission of HIV to infants, so their decision making with respect to pregnancy may be poorly informed. Only about 15–30 percent of infants born to HIV + mothers will be seropositive, and treatment can reduce that incidence to 4–8 percent. Providing education with respect to HIV and pregnancy, then, is an important educational priority as well.

2. Targeting Sexual Activity

Sexual activity is a very personal aspect of life. Consequently, knowledge of how to practice safe sex may not translate into behavior change if spontaneous sexuality is seen as an inherent part of one’s identity, as is true for many gay men. Past sexual practice predicts AIDS risk-related behavior. People who have had a large number of partners (especially anonymous partners), who have not used condoms in the past, and who meet their partners in bars or through the Internet may continue to expose themselves to risk, perhaps because those behaviors are well integrated into their sexual style. Sexual encounters, particularly with a new partner, are often rushed, nonverbal, and passionate, conditions not very conducive to a rational discussion of safe-sex

practices. To address these issues, health psychologists have developed interventions that involve practice in sexual negotiation skills.

Sexual negotiation skills are especially important in interventions with high risk groups, such as minorities, women, and adolescents. One of the reasons that young women engage in unsafe sex is the coercive sexual behavior of their young male partners. Teaching young women how to resist coercion is therefore important. Interventions also need to be focused on building self-efficacy for practicing safe sex. Interventions oriented toward reducing their sexual activity and enhancing their abilities to negotiate condom use with partners reduced risk-related behavior. Even brief but intensive interventions addressing risk factors, motivation, self-efficacy, social support, and skills may have these beneficial effects.

3. HIV Prevention Programs

Prevention programs have been developed for U.S. public schools to warn adolescents about the risks of unprotected sexual intercourse and to help instill safe-sex practices. Teenagers who are HIV + sometimes pitch these programs, making the risk graphically clear to the audience. However, adolescents may try to distance themselves from peers who have HIV in an eff ort to reduce the threat. Interventions that stress information, motivation, and sexual negotiation skills may be more successful in changing adolescent behavior. Research is still exploring which elements of school-based prevention programs are most successful.

The stage model of behavior change may be helpful in guiding interventions to increase condom use. Some people have gaps in their knowledge about HIV or about their own or their partners' behaviors that may put them at risk. Therefore, they may profit from information-based interventions that move them from a precontemplation to a contemplation phase with regard to safe-sex practices. In contrast, moving from contemplation to preparation, or from preparation to action, may require specific training in condom negotiation skills. Interventions that address the norms surrounding sexual activity are needed as well. Any intervention that supports norms favoring more long-term relationships or decreasing the number of short-term sexual relationships an individual has is a reasonable approach to prevention.

4. Cognitive-Behavioral Interventions

CBT is a guiding framework for many interventions. Many of these include a stress management component. Stress management interventions improve quality of life and mental health, but stress management may not affect immunologic functioning related to the course of illness. CBT interventions may need to be directed not only to stress management, but also to health behaviors. Smoking, excessive alcohol use, and drug use commonly compromise health and adherence among people who are HIV seropositive. Cognitive-behavioral interventions can help reduce risk-related sexual behavior, maintain adherence, and reduce viral load.

5. Targeting Adherence

Because maintaining good health for people with AIDS depends so critically on adhering to HAART, adherence is fairly high. However, stress can impede adherence, as can alcohol use. Some people who are HIV + have difficulty getting HAART, and using it may be a poor fit with their lifestyle. Homeless people, IV drug users, and alcoholics show poor adherence rates. For example, most of the drugs used to fight HIV infection must be refrigerated, and homeless people, by definition, do not have refrigerators. Practical problems related to poverty account for some adherence problems. Psychosocial resources contribute to adherence.

Those who adhere to HAART are more likely to have social support, low levels of depression, and a sense of self-efficacy. Those who fail to adhere have more psychological distress, lower social support, more avoidant coping strategies, and more use of stimulants. As is true for risk-related behavior, adherence to HAART is affected by motivational training. Having the right information, the motivation to adhere, and skills to do so significantly improves adherence to treatment. Interventions that enhance social support have also shown some success in improving adherence, and even text messaging may enhance adherence and improve clinical outcomes.

6. Targeting IV Drug Use

Interventions with IV drug users need to be targeted toward both reducing contact with infected needles and changing sexual activity. Information about AIDS transmission, needle exchange programs, and instruction on how to sterilize needles can reduce risky injection practices among IV drug users. Methadone maintenance treatments, coupled with HIV-related education, may help reduce the spread of AIDS by reducing the frequency of injections and shared needle contacts, by reducing health risk behaviors, by increasing the use of condoms, and by reducing the number of sexual partners. However, the cognitive-behavioral intervention programs that work with other at-risk populations may not work as well with IV drug users because they often lack impulse control.

**Coping with HIV + Status and AIDS**

Coping with a life-threatening illness is always challenging and may be especially so for people with HIV infection. They are more likely to have a history of traumas and co-existing mental health problems, such as anxiety disorders, depression, and substance abuse disorders. Consequently, they may not have particularly good coping skills to draw on. Moreover, people with HIV infection face particular challenges. Now that HIV infection is a chronic rather than an acute condition, psychosocial issues raised by chronic illness come to the fore. One such issue is employment. Interventions may be needed to help those who can return to work do so. People with HIV must continually cope with the fear, prejudice, and stigma that they encounter from the general community, which can increase psychological distress.

**Social Support**

Social support is very important to people with HIV infection or AIDS. Social support has been tied to greater adherence and lower viral load, for example. Thus, addressing social support needs can have multiple positive repercussion. Gay men infected with HIV who have emotional, practical, and informational support are less depressed, and men with strong partner support are less likely to practice risky sex. Intervention programs that include male partners and those that focus on building and maintaining relationship skills build on these insights. Support from family appears to be especially important for preventing depression. Not all families are helpful, however, and so other sources of support are vital. The Internet represents an important resource for people infected with HIV. Those who use the Internet to help manage their HIV + status typically are more knowledgeable about HIV, have more active coping skills, engage in more information-seeking coping, and have more social support than those not using the Internet.

# CANCER

The word cancer was first used to describe various types of tumors by the Greek physician, Hippocrates. In Greek, words such as carcinos and carcinoma refer to a crab and initially described tumors that were probably due to the finger-like projections from cancer that are reminiscent of a crab. Although cancer is often thought of as being a single disease, it is a term used to describe in excess of 200 different diseases.

Cancer is defined as an uncontrolled growth of abnormal cells, which produces tumors called neoplasms. There are two types of tumors: Benign tumors, which do not spread throughout the body, and Malignant tumors, which show metastasis the process of cells breaking off from the tumor and moving elsewhere. All cancers result from a dysfunction in DNA—that part of the cellular programming that controls cell growth and reproduction. Instead of ensuring the regular, slow production of new cells, this mal- functioning DNA causes excessively rapid cell growth and proliferation. Unlike other cells, cancerous cells provide no benefit to the body. Immortal cells are those cancer cells that are not programmed to know when to stop dividing or die. They can destroy normal surrounding tissue and have a propensity to spread throughout the body. This abnormal process of malignancy leads to the accumulation of cancer cells that eventually form a mass or tumor. If the proliferation of this cancerous growth is not halted, the abnormal cells can extend to surrounding areas and metastasize or spread to form tumors in other parts of the body. Eventually, the organs and body systems that are affected cannot perform their proper functions which can lead to death.

There are many forms of cancer, and the large majority can be classified into five types based on the kind of tissue in which it develops-

1**. Carcinomas,** are malignant neoplasms in cells of the skin and the lining of body organs, such as the digestive, respiratory, and reproductive tracts. About 85% of human cancers are carcinomas.

2**. Melanomas**, or neoplasms of a special type of skin cell that produces the skin pigment called melanin.

3. **Lymphomas**, or cancers of the lymphatic system.

4**. Sarcomas**, which are malignant neoplasms of the muscle, bone, or connective tissue.

5**. Leukemias**, or cancers of the blood-forming organs, such as the bone marrow, that lead to an extreme proliferation of white blood cells.

Many cancers run in families, in part because of genetic factors. However, family history does not always imply a genetically inherited predisposition to cancer. Many things run in families besides genes, including diet and other lifestyle factors, and overall, cancer is more closely tied to lifestyle than to genetics. Infectious agents are implicated in some cancers. For example, the human papillomavirus (HPV) is the main cause of cervical cancer. Japanese Americans have an especially high rate of stomach cancer, and Chinese Americans have a high rate of liver cancer. Breast cancer is extremely common among northern European women and is relatively rare among Asians. This increase in vulnerability is believed to be linked to changes in diet. Most cancers are related to socioeconomic status, with low-SES individuals more at risk. Dietary factors are also implicated in cancer development. Cancers are more common among people who are chronically malnourished and among those who consume high levels of fats,

certain food additives (such as nitrates), and alcohol (American Cancer Society, 2006). The risk of developing cancer typically increases with age, especially from the middle-age years onward: over 75% of all cancers are diagnosed in people 55 years of age and older (ACS, 2006). Taking age into account, the incidence rates of cancer are higher for males than females in many countries. In the United States, the risk of developing cancer in one's lifetime is 1 in 2 for males and 1 in 3 for females (ACS, 2006) For men, the most common cancers are expected to be cancers of the prostate, lung and bronchus, and colon and rectum. Among women, the three most diagnosed cancers are breast, lung and bronchus, and colon and rectum. The prognosis for cancer depends on how early it is detected and its location. Diagnosing cancer can involve three medical procedures. First, blood or urine tests can suggest the presence of cancer by revealing telltale signs, such as unusual levels of certain hormones or enzymes. Second, radiological imaging, such as X-ray and MRI, allows physicians to see the structure of internal organs and whether a tumor exists. Third, in a biopsy, a physician takes out a small piece of suspicious tissue and has it analyzed. Even when the tissue is deep within the abdomen, it can generally be removed with minor surgical procedures and a local anesthetic.

The ideal goal of cancer treatment is to cure the disease, to free the person from it forever. This ideal is possible when all the neoplasms are found and eliminated. If not all the cancer was eliminated, the patient's symptoms may disappear for a time or go into remission only to return at a later date. Sometimes physicians can be reasonably certain that all the cancer was removed, but often they cannot be sure. This is why they use the individual's survival for at least 5 years as a gauge of a treatment's success. There are basically three types of treatment for cancer—surgery, radiation, and chemotherapy, that may be used singly or in combination. When choosing the treatment components, patients and practitioners consider many factors, such as the size and site of the neoplasm, whether it has metastasized, and how the treatment will affect the patient's quality of life. Additionally, there are immunotherapy and bone marrow transplantation which are relatively recent treatment methods.

Cancer results from an interaction of genetic, environmental, and behavioral conditions, most of which are still not clearly understood. Most risk factors for cancer relate to personal behavior and lifestyle, especially smoking and diet. Other known behavioral risks include alcohol, physical inactivity, exposure to ultraviolet light, sexual behavior, and psychosocial factors.

Psychosocial factors in the initiation and progression of cancer.

Stress has also been shown to have to play a role in cancer. Laudenslager et al. (1983) reported a study that involved exposing cancer-prone mice to stress (shaking the cage). They found that if the stressor could be controlled there was a fall in the rate of tumour development. However, if the stressor was perceived as uncontrollable, it resulted in an increase in the development. Fear of the future is a common and severe stress reported by cancer patients. Stress generally has not been linked to the onset of cancer, a particular type of stress—lack or loss of social support—may affect the onset and course of cancer. The absence of close family ties in childhood predicts some cancers and the absence of a current social support network has been tied to a worsening course of illness. Experiencing major social stressors such as divorce, infidelity, marital quarreling, and financial stress increases the risk for cervical cancer. A long-term study of cancer incidence, mortality, and prognosis in Alameda County, California, found that women who were socially isolated were at greater risk of dying from cancer at all sites.

Depression is implicated in the progression of cancer, both by itself and in conjunction with other risk factors. Research has found an 18.5-fold increase in risk for smoking-related cancers among smokers who were depressed, as well as a 2.9-fold increase for non-smoking-associated cancers. People who were depressed or anxious prior to having cancer may be especially benefitted by interventions. Bieliauskas (1980) highlighted a relationship between depression and cancer and suggests that chronic/mild depression, but not clinical depression, may be related to cancer. Those who have high levels of hopelessness, depression, and other psychosocial vulnerabilities have been found to survive for shorter periods after diagnosis than others do perhaps because of the effects of stress and negative emotion on immunity. Major depression affects approximately 25% of cancer patients. However, the variability in the incidence of depression among cancer patient samples has been found to vary from 1% to 53%. Depression is also responsible for the largest percentage of psychiatric consultations for cancer patients. Factors associated with greater prevalence of depression are a higher level of physical disability, advanced disease stage, and the presence of pain. Also, higher rates of depression have been associated with the side effects of medications and treatment for cancer.

Behavioural factors have been shown to play a role in the initiation and promotion of cancer. Smith and Jacobson (1989) reported that 30 per cent of cancers are related to tobacco use, 35 percent are related to diet, and 3 per cent are due to alcohol. These behaviors can be predicted by examining individual health beliefs.

It has also been suggested that life events play a role in cancer. A study by Jacobs and Charles (1980) examined the differences in life events between families who had a cancer victim and families who did not, they reported that life events may well be a factor contributing to the onset of cancer. Several individual studies report a relationship between life events and breast cancer. But when the data across the different studies are merged, the results from other research show no good evidence of a relationship between stressful life events and breast cancer.

Coping styles are also important. If an individual is subjected to stress, then the methods they use to cope with this stress may well be related to the onset of cancer. For example, maladaptive, disengaged coping strategies, such as smoking and alcohol, may have a relationship with an increase in cancer.

Studies indicate that anxiety increases during certain periods of the disease, such as the discovery of the tumor, then peaks during surgery and remains high until a year subsequent when it begins to decline. For some patients, anxiety can become so severe that they may be unable to adhere adequately to their medical treatment and seek to avoid fear-provoking procedures. Some researchers have suggested that cancer survivors may respond to psychological distress and uncertainty about the future by displaying posttraumatic stress disorder. (PTSD) with symptoms similar to those experienced by victims of war or environmental disasters.

The risk for suicide may be greater in the advanced stage of the illness and with patients experiencing significant fatigue. There are also periods during the course of the disease when patients may be at an increased risk for suicide. These include periods of hospitalization, immediately after discharge, and at the time of recurrence and/or treatment failure. As depression and hopelessness have been found to be causally linked to suicide, the degree to which cancer patients experience such feelings may increase their vulnerability to suicide. In

fact, hopelessness has been found to be a better predictor of completed suicide than depression alone. The fear of death or of recurrence of cancer may develop into suicidal ideation.

Delirium is a common psychiatric problem among cancer patients because of the direct effects of cancer on the central nervous system (CNS) and the indirect CNS complications of the disease and medical treatment. Delirium can often go unrecognized because it mimics depression. Symptoms consist of agitation, impaired cognitive function, altered attention span, and a fluctuating level of consciousness. Delirium can be attributed to medications, electrolyte imbalance, failure of a vital organ or system, nutritional state, infections, vascular complications, or hormone-producing tumors. Prevalence 8-40%. Risk for delirium are in-patients, elderly patients, and those with advanced or terminal disease.

Body image problems. The scars and physical disfigurement serve as reminders of the painful experience of cancer and its treatment. The stress and depression that may be a result of body image concerns can further impact other areas of the patient's and family's life, such as sexual intimacy, psychological disorders, and self-esteem. In women who have had breast surgery, concerns range from distress over scars to feelings of decreased sexual attractiveness and restrictions of the use of certain items of clothing. In a study of women who had breast-conserving surgery, 25% had serious body image problems.

## COPING WITH CANCER AND INTERVENTIONS

Cognitive behavioral approach. Focusing on depression, stress, fatigue, pain, appetite control, and side effects associated with chemotherapy, radiation therapy, and other cancer treatments. These interventions can significantly improve quality of life. Cognitive- behavioral stress management program- The program improved their adjustment in two ways: it reduced the prevalence of depression and increased their use of positive reappraisal strategies, such as seeing benefits to their condition; these effects were strongest among women whose optimism was low at the start. And the program enhanced the women's immune function. This program also has been found to reduce women's cancer- related anxiety, general anxiety symptoms, cortisol levels, and levels of inflammation. The main factor in the success of this stress management program is the patients' learning skills that allow them to relax.

Relaxation and systematic desensitization. Studies found that training patients to use progressive muscle relaxation and imagery before and during chemotherapy sessions sharply reduced the development of nausea after the first session. Another study showed that systematic desensitization can help people who have already developed anticipatory nausea. Patients used relaxation techniques while they imagined increasingly difficult scenes relating to chemotherapy, such as driving to the clinic or entering the waiting room. These individuals reported much less nausea and vomiting in subsequent chemotherapy sessions. Not all patients benefit from these techniques, partly because they don't believe psychosocial approaches will help.

Mindfulness-based stress reduction interventions. A mindfulness intervention with breast and prostate cancer patients involving the active cultivation of conscious awareness through relaxation, meditation, and yoga not only enhanced quality of life and decreased stress symptoms, it also produced a beneficial shift in immune functioning. It has been found to reduce depressive symptoms and other indications of emotional distress in cancer patients.

Pain management. One of the main roles of psychology is in terms of pain management, and this has taken place through a variety of different pain management techniques. For example, biofeedback and hypnosis have been shown to decrease pain. Turk and Rennert (1981) encouraged patients with cancer to describe and monitor their pain, encouraged them to develop coping skills, taught them relaxation skills, encouraged them to do positive imagery and to focus on other things. They reported that these techniques were successful in reducing the pain experience.

Social support interventions. Social support interventions have also been used through the provision of support groups, which emphasize control and meaningful activities and aim to reduce denial and promote hope. The results showed that higher levels of perceived social support and approach coping strategies were related to positive adjustment. Various types of supportive therapies and coping skills training also help manage cancer patient's depressive reactions. Attending support groups include education, group discussion, and coping skills training. Other coping skills include self-hypnosis, writing interventions involving expressive disclosure or writing about benefits derived from cancer. The opportunity to affirm important personal values and the use of emotional approach coping.

Body image counseling. The quality of life of cancer patients may also be improved through altered body image counseling, particularly following the loss of a breast and, more generally, in dealing with the grief at the loss of various parts of the body.

**THERAPEUTIC INTERVENTIONS.**

Individual Therapy. In individual therapy, therapists working with cancer patients try to focus on the specific issues faced by the patient rather than undertaking a more general, probing, long-term analysis of the patient's psyche. The most common issues arising in individual therapy are fear of recurrence, pain, or death; fear of loss of organs because of additional surgeries; interference with valued activities; practical difficulties, such as job discrimination and problems with dating and social relationships; and communication problems with families.

Family Therapy. Emotional support from family is beneficial to cancer patients, and family therapy is often employed. Not all families are able to communicate freely with each other, though. When there is a mismatch in the social support wanted and received by cancer patients, psychological distress may increase. Couples coping with cancer may benefit from couples' intervention.

Support Groups. Self-help groups in which patients share emotional concerns are available and helpful to many cancer patients, especially those who have few other personal or social resources. A possible reason for the success of support groups is that the self- help format presents patients with an array of potential coping techniques from which they can draw the ones that fit in with their particular styles and problems. However, only a small percent of people takes advantage of support group opportunities. However, the Internet is now used extensively by cancer patients for social support from other cancer patients.

Adjuvant psychological therapy. In addition to physical interventions, patients with breast cancer should be offered adjuvant psychological therapy. This involves encouraging cancer patients to examine the personal meaning of their cancer and what they can do to cope with it.