**Effects of Stress and Psychological Disorders on the Immune System \***

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This is a review of the psychological field of psychoneuroimmunology (PNI) and how psychopathology has an impact on the immune system. Two areas of study of PNI are examined: first, how the psychosocial environment affects the health of an individual along with the impact stressors play on the immune system; second, the effects of psychopathology on the immune system and how perceived stresses are assessed. Coping strategies are also looked at where in some cases they have shown abilities in strengthening the immune system. The understanding of PNI is crucial in understanding the association between immunity, depression, stressors, and psychosocial aspects, along with their interactions with each other and their causal relations.

This is a review of a growing new field called psychoneuroimmunology (PNI), which incorporates facets of psychology, immunology, and neurosciences amongst many other fields. It attempts to understand the interactions between the nervous system, immune system and psyche. This is a rich area of research in which much work has done with many different theories. Specifically, one highly active area of research is where psychologists have been studying the effects that stress and psychopathology have on the immune system. This research has found correlations between stress, depression and the immune system.

**The Immune System**

The immune system is basically an interaction between cells and cellular products. The white blood cells (leukocytes), which are the main fighter cells of the immune system are made up of three classes; lymphocytes, monocytes, and granulocytes. Each type of cell has its own functions. Lymphocytes for instance, are subdivided into B cells, T-helper cells, T-suppressor cells, and natural killer cells. B cells are generally responsible for the production and secretion of antibodies. T-cells are responsible for making close and direct contact with the antigen. The other T cells are responsible for regulating the immune system; T-helper cells enhance whereas T-suppressor cells decrease the response.

In measuring the immune response, there are two basic ways; quantitatively measuring levels of cells, or second by using a functional measurement. In quantitative measurements, they are either a measure of the number of cells in a given volume of blood, or a percentage of each type of cell. In a functional measurement, lymphocytes, for example, are exposed to a non-specific antigen (mitogen) and the results of the exposure are then observed (O'Leary, 1990).

The psychosocial state of a person can have direct impacts on the immune system. For instance, stress has many different effects on the endocrine systems, including the well known fight or flight activation which is activations of the sympathetic adrenal-medullary (SAM) system, the hypothalamic-pituitary-adrenocortical (HPAC) system, and other endocrine systems.

**Effects of Stress on the Immune System**

Internal factors such as stress have been implicated in causing a deficient immune system because of the nature of the body's response in dealing with this problem. The capabilities of the immune system are diminished after frequent activation of the autonomic nervous system in the case of chronic stresses. The immune system is downgraded to be able to continuously functioning.

In a large study involving parents of both children with cancer and parents with children who were relatively healthy, the results showed that chronic psychological stress might reduce the immune system's reactions to hormonal secretions that were normally used to fight the inflammatory response (Miller, Cohen, & Ritchey, 2002).

Perceived mood also seems to play a role in immune system effectiveness. Having a positive attitude seems to correlate with an increased ability of the immune system in fighting diseases. In cases where patients have exhibited fear before a surgery, they have had a longer healing time afterwards. Correlations were observed in the number of lymphocyte cells and the person's level of optimism.

Cardiovascular diseases are another area where stress could have a negative effect. The natural response of the fight or flight activation mechanism could have a decidedly negative impact on the cardiovascular system. Since the activation of the fight or flight system involves an increase in the heart rate, a frequent activation could increase the possibility of a heart attack or other negative aspect of the disease. Specifically, a study was done in an industrial work environment in which a much higher frequency of cardiovascular mortality was found to correlate with an environment in which there was very little reward incentive (Kivimaki et al., 2002).

Even in relatively less dangerous health problems, mood can have an effect. A study with the common cold and emotions showed that participants with happy emotions exhibited a greater ability to fight off the cold when given a squirt of the rhinovirus (Jones, 2003).

A study done on students in an academic environment during exam time produced some convincing results. In the study, the level of T-cells and responses to mitogens was lower. Secondly, there was a higher self-reported occurrence of health problems, such as, upper respiratory-tract infections (O'Leary, 1994).

In the case of external factors, the social environment could play a huge role in immune functioning. If a person has an effective social support web, it has been shown to effectively increase the immune's systems abilities. The cardiovascular system could also have a positive response to this type of social support. Having positive social support could aid in blood pressure regulation, thus reducing the probability of a heart or related disease.

**Coping Strategies**

The definition of stress can be confusing. It can be a stimulus or demand, a response, or it may involve a process that involves both. Seyle is the champion of the commonly believed process of the physiological response; the alarm stage, resistance stage, and the exhaustion stage or also known as the general adaptation strategy. Lazarus promoted an alternative to this theory that also involves the emotional or psychological based response of the individual when faced with a stress. In his model, cognitive factors come into play like the cultural background of the individual or past experiences. First an individual determines the degree of threat that is perceived by the stress. Next coping strategies are assessed by the individual to effectively deal with the confronted situation.

Cox determined that both physiological and psychological components were equally important. He also recognized that each individual incorporated their own coping strategies.

The strategy an individual uses to cope with stress has in some studies shown a strong relationship with the ability of the immunes system. In the case of cognitive-behavioral stress management therapies, there has been shown effective means at reducing stress. The ability to proactively handle how one deals with their stress in everyday life could alleviate the constant activation of the endocrine system, which in turn increases the effectiveness of the immune system (Jones, 2003).

Inhibition of emotions could be another stress factor negatively affecting health. Bottling up negative emotions seems to tie up resources of the immune system. Individuals who disclosed a tragic event seemed to have an elevated immune response and generally were healthier than those who inhibited expression of these emotions. There is considerable evidence that talking about problems and using mental health services, decreases the number of sick days, and lowers health costs for these individuals (O'Leary, 1990).

Using a coping strategy which involves a denial or assessing that a particular illness or stress is beyond the control of the individual can prove to be an ineffective strategy. The person tries to escape reality, and refuses to use their social network to help deal with their problem. They believe that work requirements are more important than seeking therapy or treatments. This strategy can have a tragic result on an individual (Jones, 2003).

A large study of individuals with Aids was conducted in which participants of the study group were given advice on health, stress management techniques, psychological support, and problem solving skills regarding diagnosis. Initially after the 6-week study, there wasn't a noticeable result, but a follow up 6 months later showed profound decreases in psychological distress and higher levels of immune functioning (Glaser & Glaser, 1992).

**Behavior Change**

The field of PNI is not without controversy. One of the debatable topics is the causal relationship between stress, depression and immune response. Depression has been implicated in causing behavioral changes in people with major depressive disorder. Some of these lifestyle changes can be profound, such as, not eating, drug abuse, or disturbed sleep patterns. Some argue that it really is these "lifestyles" which is the culprit in reduced immune functioning. Having bad nutritional habits could starve the body of necessary nutrients to maintain high levels of white blood cells. As a result, the immune system downgrades its functioning and the person becomes more prone to diseases or inflammatory.

In a study done with depressed women and physical activity, 42 to 63 percent of the differences in immune functioning were observed to be related to physical activity. The study observed 32 depressed women and 32 non-depressed women. The production of lymphocytes was measured to determine the immune system's functioning (Hendersen, 1999).

Patients with cancer can have significant lifestyle changes as a result of their condition. They will have poor eating habits because of nauseating feelings which were not directly related to their treatments or conditions. They have disturbed sleep patterns, such as insomnia or waking up early. They also frequently develop drug problems. All of these factors seem to add additional stresses which impact the physiological effects. Targeting these stresses has had positive results on the health of individuals. Again, a study done with physical activity not only helped eliminate the bad physical habits, but it also decreased the depression and gave the clients a positive outlook (Anderson, Glaser, & Kiecolt-Glaser, 1994).

On top of lifestyle changes, a person's response to a known acquired disease, or even having symptoms of a disease could be another factor. A person under heavy stress or extreme depression may forgo seeking treatments for physical illness, thus increasing the likelihood of an escalation in the physical problem.

**Effects of Psychological Disorders on the Immune System**

**Depression and Stress**

The issue of whether stress causes depression or vice versa is another area of concern for PNI. Some wonder if depression is caused by stress or if depression itself is a form of a stressor. Pinpointing which is the primary cause of reduced immune response in PNI can be difficult.

Because both can be products of each other, it can be almost impossible to determine which has a more important role in effecting an individual's health. Stress can come in many forms. Anxiety causes stress, depression causes stress, and life events can also cause stress. On the other hand, stress can also trigger a major depressive disorder.

One theory of how stress can cause depression has its roots in the brain's mood and pleasure pathways. The stress exposure can cause the glucocorticoid hormone to be overly active which causes a depletion of norephinehprine levels in locus coeruleus neurons. This has an effect of slowing the attentiveness within the individual. They become emotionless and inactive (Salzano, 2003).

Perceived stress is quite possibly a cause in and of itself as well. One person may see a stressor as a far greater problem than another individual who may not feel the same degree of "stress" from the stressor. If an individual experiences great anxiety because of constant thought about a stressor, their fight or flight mechanism could be in perpetual heightened response. Just thinking about the stressor could set off the elevated response. These stresses amount to a constant initiating of the response multiple times a day if the thoughts preoccupy the individual.

**Schizophrenia and the Immune System**

There is a considerable amount of evidence that schizophrenic patients have longer healing times after major surgeries. A study investigated the levels of plasma interleukin in the blood of twenty-five control and schizophrenics during all stages of the surgery process of hemicolectomy and sigmoidectomy. Plasma IL-8 levels were significantly lower in the schizophrenic patients after surgery. Plasma cortisol concentrations were significantly lower during surgery for the schizophrenic patients as well. The conclusion of the study was that schizophrenic patients had a reduced ability for cytokine to fight inflammations. The reason for the findings could be explained by a schizophrenic's hypothalamus-pituitary-adrenal dysfunction. The endocrine system has close interactions with the immune system (Kudoh, Sakai, Ishiria, & Matsuki, 2001).

**Summary and Future Considerations**

This paper has shown that the immune system is not an isolated entity from the psychosocial state of an individual. A person experiences many stressors throughout a day and lifetime. These stressors are affecting the ability of the immune system to function at the highest possible level. Many important studies have shown that there is a correlation between these stressors and a person's health.

A person's psychological state is also a prominent factor in health. Depression influences the health of a person either by having a direct relationship with the immune system, or by indirectly influencing how a person takes care of themselves.

It is difficult to doubt that immunity and a person' psyche are interrelated, but what is difficult to explain is the causal relationship. What is really causing what? Some argue that stress causes depression, which causes the immune system to function improperly because resources are tied up in activating the fight or flight mechanism. Others argue that depression causes stress, which then causes fight or flight. And yet another group argues that a person's psychological state causes the individual to indirectly affect their health by bad nutritional, physical and sleep patterns.

Future studies need to address these issues. First, long term studies on people who both exhibit and don't exhibit depression and their daily stresses need to be done. The stresses these individuals experience and their responses, whether they are physical or not, need to be catalogued. Is the person experiencing stress directly related to the depression, or is depression a non-factor in the stresses. The person's health throughout the time they are experiencing the problems must be measured in different degrees. The degree of health problems, and their associated stressors or depressive states needs to be compared to determine whether stress or depression is the prominent factor.

Lastly, and most important, a person's physical habits need to be monitored to determine if the immune response is solely, partly or not at all affected by the individual habits and not the stressors or depression.

The purpose of this review was to show that a person' psychosocial environment is a primary cause either directly or indirectly in how a person feels physically, or recovers from illness. This could have profound implications in future treatments administered to people with morbid diseases. Psychotherapy and behavioral therapy may prove to be an extremely useful tool in helping these individuals to recover or deal with their illness without inhibiting the natural abilities of the immune system. If we know the true cause effect relationship, we could develop these psychosocial treatments to specifically deal with not only the individual's health state, but also their depression or stressors, which in turn could improve the chances of physically recovering.

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