

## Regenerative Medicine: Stress, Emotional Intelligence and Patient Care

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### Abstract

Over the last two decades, there has been a growing interest in both regenerative medicine and emotional intelligence. Attention to advancements in autologous cell therapies has been overshadowed in recent times with the COVID-19 pandemic, which has compounded emotional stressors affecting health care that came before it. The importance of this connection and the underlying role of stress on the immune system requires further exploration.

This article highlights the role that stress and the immune system have in the healthcare setting and explores how psychology affects the clinical environment. Additionally, it discusses how healthcare workers can leverage emotional intelligence to enhance therapeutic outcomes in their patients and improve overall health status for themselves.

Especially in the past year, there has been a growing interest in the importance of emotional intelligence in managing the compounding effects of the COVID-19 pandemic on both patients and healthcare workers, and this has further underscored the importance of mind-body health management. The growing awareness of emotional intelligence and education on health will undoubtedly shape the next decade of medicine.

### No Facilitating Regenerative Medicine:

Regenerative medicine can be described as healing from within to facilitate the repair or combat degenerative disease using primary cells and genes. In typical applications of regenerative medicine, cells are harvested from a candidate and grown in a lab for expansion and later delivery or to administer in appropriate ways to facilitate repair, rescue and regenerate organs throughout the body. These cells can be obtained from numerous sources, including peripheral blood, bone marrow, skin cells, or fat cells. An ideal candidate for regenerative medicine therapy would provide optimal cells for harvest while also being a highly receptive recipient for transplanted cells that are primed for cell therapy. The immune system has an important role in this process, both as the source of the majority of cells used in cell therapy, but also as a facilitator for priming the body for therapy. To this end, there may be an

important role for emotional intelligence for both the candidate and the medical and healthcare practitioners.

### Priming the Body:

An important aspect of cell therapy lies beyond the isolation of ideal cells for regenerative therapeutic applications. It may be possible to prime the body to activate innate regenerative processes that set the stage for conditions to be receptive for cell transplant therapy; and this could involve slowing down degenerative processes-independent of cell therapy. The key to this aspect may lie in a psychosomatic aspect of regenerative medicine that connects the immune system and possibly external stress management which-if left unchecked, could trickle down into physiological stress responses. A mind-body connection in healing and combating emotional stressors may be a central process for the success in regenerative medicine therapy. In this aspect, there is

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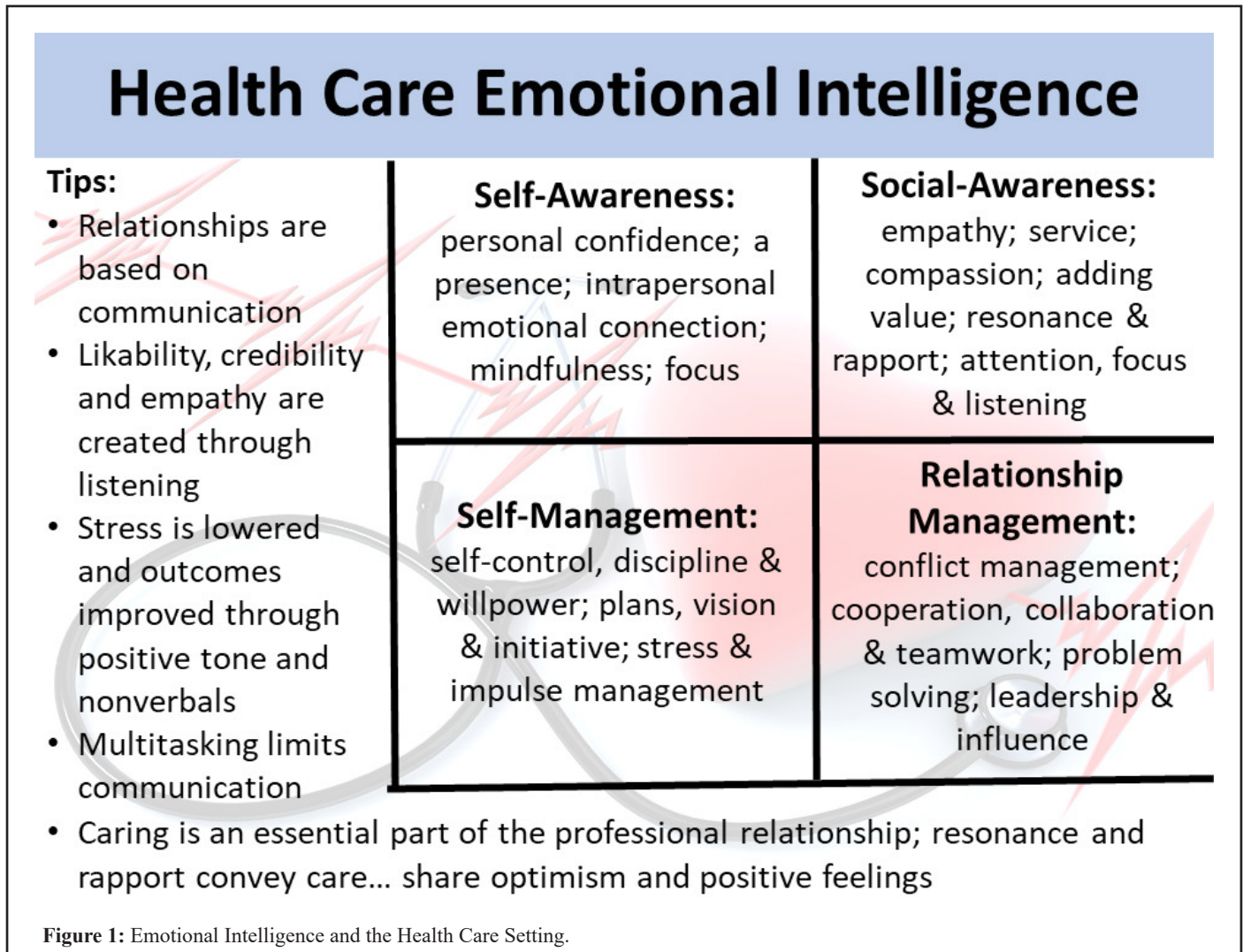
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a key cycle connecting biology to psychology and self awareness that involves emotional intelligence.

**What is Emotional Intelligence?**

Emotional intelligence is the capacity to recognize the emotions of oneself and others, then to guide thinking and behavior in response or adaptation to the environment or to achieve goals. Emotional intelligence involves sensitivity to the needs of others, with an understanding of behavioral cues. It is not a result of innate talent, and it is always a result of education.

Emotional intelligence can impact how to seek help and inhibit others from alleviating personal stress. It relates not only to responding to external stress response but also leveraging the right tools to negate the internalization of stressors that can ultimately turn pathological. Competency in emotional intelligence allows channeling and gauging self strengths and weaknesses to accurately express personal emotions to negate external stressors. The software-hardware relationship of emotion to physiology and interpersonal interaction with external stressors may be the key to treating many chronic degenerative factors leading to aging, heart disease, and an overall candidacy for successful



**Figure 1:** Emotional Intelligence and the Health Care Setting.

applications of therapies in regenerative medicine.

**Stress & Immune System in Regenerative Medicine:**

In regenerative medicine, the immune system plays an important role in self-repair and maintenance. The immune system interacts with many aspects of the nervous system that are critically important in instances of chronic stress. Through a highly conserved evolutionary process, stress activates the sympathetic nervous system through glucocorticoids, catecholamines, and neuroendocrine factors. This is a necessary and natural evolutionary process for safety that interacts with the immune system for short periods- If left unchecked, chronic stress can lead to degenerated wound healing, diminished infection recovery, or dysregulation in biological systems relating to the innate

stress response.

Research into chronic stress found that abused children were more prone to growing into adults facing binge drinking, heavy drinking, smoking, risky HIV behavior, diabetes, myocardial infarction, coronary heart disease, stroke, depression, disability caused by health. Blood pressure, heart rate, breathing is all interconnected components of the autonomic nervous system. Additionally, the autonomic and sympathetic nervous system works with the enteric nervous system to regulate vagus nerve stimulation. The enteric system has a brain-inside-the-gut function and digestion is modulated in response to stress responses. Under fight-or-flight status, the system favors support to sustaining muscles than typical functioning of the gastrointestinal system. With uncontrolled chronic

stress situations, these challenges to the gastrointestinal system lead to systemic pathologies, inflammation and cardiovascular morbidity.

#### Result of Stress on GI and Behavioral Environment:

Heart disease, high blood pressure, and elevated resting heart rate levels can result from chronic stress, affecting cardiovascular function, blood clotting, and hepatic health. Uncontrolled and continued morbidity can compound negative emotional sentiment and destructive coping mechanisms such as alcoholism. It should be noted however, that in animal models resveratrol the active compound found in red wine has shown cardio-protective effects in negating some degenerative effects from morbidities such as hypertension which can result from stress. Perceived psychological stress connects the behaviors of individuals to their environment and internal physiological state and may manifest in the form of maladaptive eating or other social behaviors such as pessimism and depression which are correlated with stress and heart disease.

#### Physiology Affects Behavioral Expression and Coping:

Non-verbal cues are subconscious windows to internal states such as stress and happiness, which reflect internal physiological processes like stress hormones. In the same manner that behavior reflects internal physiological processes and health, the facial-feedback hypothesis suggests that the converse is also true, facial expressions can help regulate emotions too. The act of smiling or frowning itself can change the experiencer's mood. The concept of facial-feedback can tie into cultural norms and attitudes as customary expressions of emotion can vary from culture. Cultural attitudes or norms can influence behaviors such as inclination for cosmetics surgery. It has been suggested that cosmetic injections of botulin toxin BOTOX which neutralizes muscular effectiveness, sadness and can make individuals happier through this feedback. Some cultures emphasize hand gestures to express emotion. Many gestures can resemble each other but mean different things in different cultures; for instance, thumbs up and peace signs, for example. Additionally, cultural attitudes, norms, and differences can also influence attitudes towards lifestyle behaviors, misinterpretations, or habits, which can also affect overall perception and mood.

#### Hormones Affect Emotions:

The intricate relationship connects lifestyle factors, hormonal states, and emotional states. For instance, lifestyle factors can affect sleep and the circadian rhythm, affecting energy levels and overall productivity or success, thereby affecting the overall perception of stress and in turn, emotional state. In chronic states, this could lead to an overall imbalance or hyper- or hypo-activation of the stress response system in association with the continued presence of stressor can alter normal balanced hormonal homeostasis leading to a state of cacostasis or allostasis, that can emerge in the form of many clinical manifestations. These factors could compound into social problems that trickle into work performance, income and existential matters. Ultimately a chronic imbalance could lead to diabetes, hypertension, or even cancer. Traits such as self-awareness, self-expression, and communication can be leveraged to seek help and remedy to break out of the cycle, highlighting the importance of emotional intelligence.

#### Biology to Lifestyle:

A connection between lifestyle factors and how they translate into regenerative medicine is their impact on the immune system. The mononuclear cell fraction of peripheral blood contains immune cells used in cell therapy applications for cardiovascular medicine. The proportion of immune cells that make up the fraction that can be grown successfully in a lab for regenerative medicine applications to facilitate cardiovascular repair fluctuates -in reflection to age, overall health, lifestyle, and emotional and mental state. Umbilical cord blood, as well as younger and physiologically healthy individuals, typically possess a higher potential for immune cells that will be well adapted for cell therapy applications. The reasons for this are unclear but may be related to physiological processes utilizing these cells in muscle generation, immune maintenance, and adipogenesis.

Biological factors like cytokines are released by cells in response to stress hormones. These cytokines can interact with molecular pathways that switch on and off process that promote regenerative physiological states and aging. Under chronic stress, basal self-repair processes gradually shifted towards a bolstered biological stress response while other basal processes deteriorate. Sleep decline is a downstream result of stress and relates to physical inactivity, gradual muscle atrophy, and a cascading feed-back exacerbated my negative psychology and its systemic physiological impact. Exercise and a healthy diet counteract this process from the downstream by activating mechanisms that promote muscle regeneration and nutrient uptake. But resistance exercise and a good diet are typically among the first negative psychological adaptations in stress response.

#### Emotion-Immune Healthcare Workers:

The connection between the immune system and emotional intelligence can be leveraged to immunologically prime candidates for biological regeneration in pre - and post-operative states. Emotional intelligence holds the potential to reduce recovery times and improve patient response to therapy while concurrently helping combat workplace stress among medical professionals, especially in a post-COVID-19 world. It represents possibly the largest cost-value gain in health care service in the coming decade. Emotional intelligence can be used to educate both patients and healthcare workers to negate maladaptive isolating social behaviors and rather refine introspection and engage in obtaining outside help in alleviating emotional stress. In this aspect, an understanding and attentive responsiveness to behavioral cues are important.

#### Educating on Relationships for Emotional Intelligence:

One of the most fundamentally important components of emotional intelligence is in educating, and training medical personnel in techniques and communication, between each other and patients. Education is the key to emotional intelligence and priming the body for regenerative medicine. Education allows communication to break barriers to interpersonal expression and facilitate the development of emotional intelligence.

#### Emotional Intelligence and Wellbeing:

Emotional intelligence provides a foundation for self-awareness and

management that leads to overall wellbeing. Through self-awareness, internal systems can receive the attention they need to perform at optimal levels. Wellbeing encompasses mental, physical, and emotional health. While frequently viewed as separate systems, they function as a whole. Neglecting any one of these areas results in negative repercussions in the other two. For higher-level functioning, the baseline requirements include:

#### Diet:

- Brain hydration: about 75% of the brain is water. Imbalance will cause impaired performance, depression, and memory difficulties. Extended dehydration results in long-term impairment and deficits.
- Nutrition: Diet is essential to optimal performance. Quantity and quality allow for constructive development, performance, executive functioning, memory, emotional regulation, and overall health.
- Happiness/positivity:

o Gratitude: increases happiness and reduces depression. It is associated with improvements in the immune systems and superior flows of constructive chemicals in the brain. People who experience and demonstrate higher levels of gratitude demonstrate higher levels of resiliency mentally, emotionally and physically.

- Supports the brain's neurological brain pathways
- Lowers anxiety, depression, and negative moods
- Shifts heart rhythms facilitating calmness and emotional control
- Enhances sleep/rest patterns while reducing inflammation
- Improves overall resiliency
- Generates higher levels of compassion, emotional resonance and interpersonal relationships
- Creates overall wellbeing

#### Joy and happy feelings:

- Protect the heart
- Improve life expectancy
- Impact the activity of the hypothalamic-pituitary-adrenal (HPA) axis, which regulates your immune system, hormones, digestion and stress levels
- Combat stress
- Reduce pain
- Create heightened overall hardiness

#### Rest and relaxation:

- Sleep plays a critical role in neuroplasticity and neurogenesis. During this time of relaxation, when sensory input is decreased, the brain is active in creating and refreshing/solidifying neural pathways. Sleep empowers information processing, creativity, memory connection, learning, and allows for higher levels of mental focus.

- Sleep replenishes brain energy and allows for overall regeneration of physical resources
- Sleep plays a critical role in allowing the brain to cleanse itself and remove toxins that inhibit performance.

#### Emotional activity/stimulation:

- The mind is made to perform. It actualizes through doing. Play, mental exercises, stimulation, challenges... establish internal conditioning for quality results.
- Puzzles, games, and various mental exercises enhance resiliency and mental fitness.

Mindfulness: the intentional awareness of internal and external variables. It encompasses situational attention and effectiveness. Mindfulness includes meditation and reflection.

- Effectively manages pain and lowers perceptual impact
- Mitigates stress and anxiety (lowers levels of cortisol)
- Reduces risk of cardiac events and strokes by almost 50%
- Lowers PTSD
- Enhances engagement and performance
- Supports positive immune systems

#### Reduction of negative emotions:

- Improves self-management and control

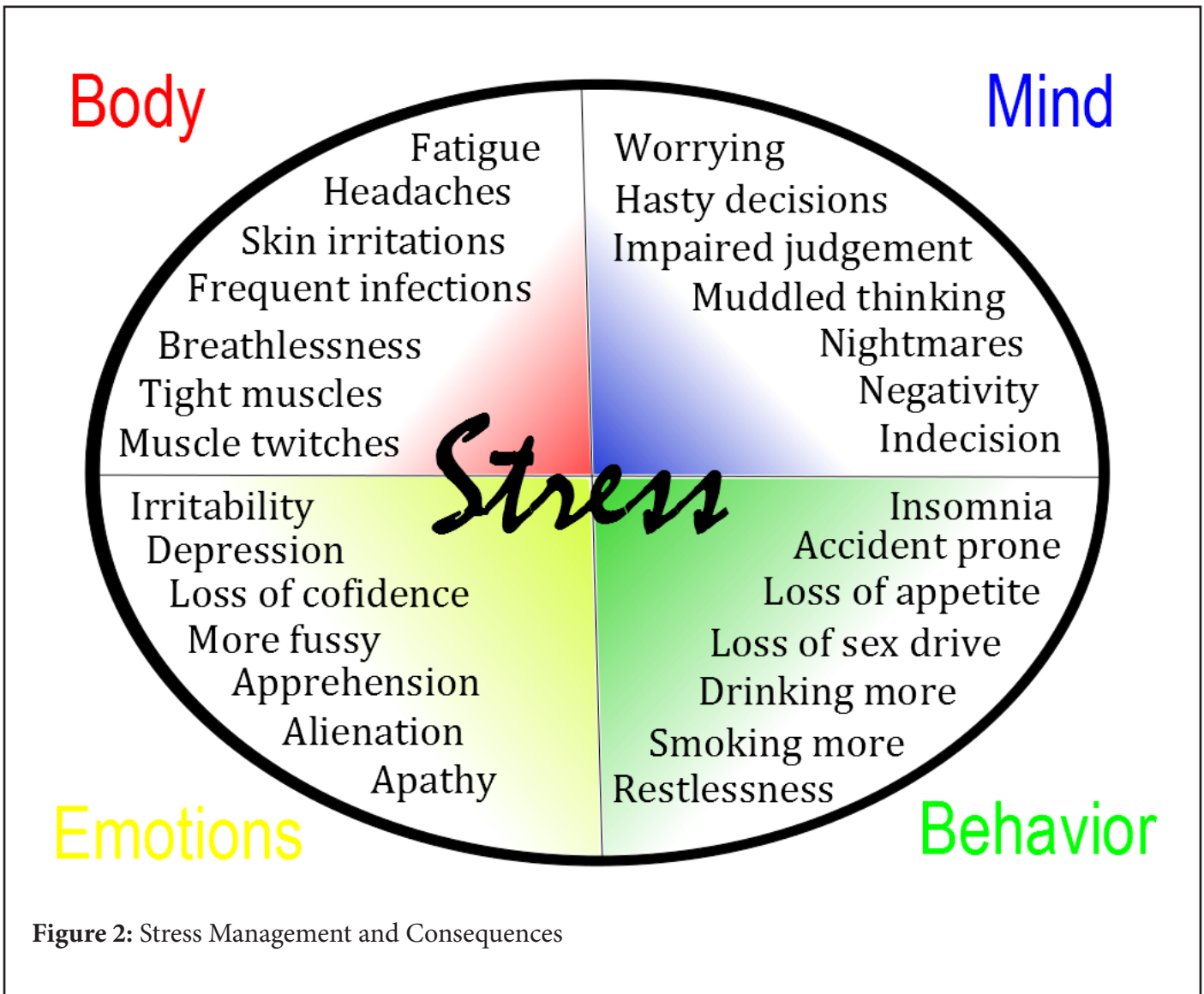
Limits toxic effects of associated negative brain chemicals

- Provides for better physical, mental and emotional wellbeing
- o Relationships and emotional support structures
- Interpersonal connection amplifies feelings of wellbeing and positivity
- Emotional structures associated with relationships provide chemical support stronger immune systems.

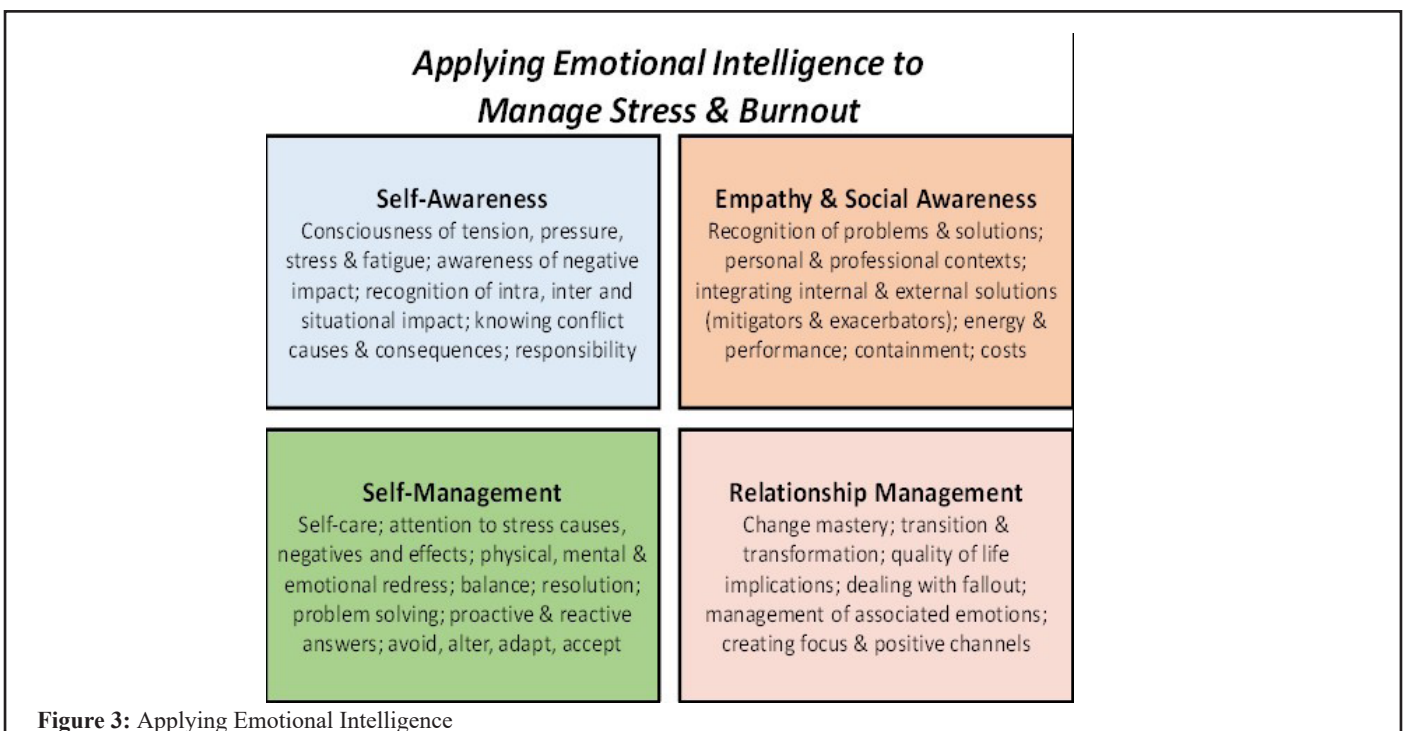
#### Stress Management:

Stress has an array of noxious impacts on mental, emotional, and physical systems. It depletes resources and strains the immune system. It is estimated that between 70 to 90% of all illness is stress-related. As a side effect, stress heightens physical discomfort while raising hostility. Again, emotional intelligence systems directly address stress causes, systems, and long-term impact.

Management of stress can be initiated through self-awareness, managed through self-regulation and further mitigated through social interaction and relationships. Through applying emotional intelligence, the draining impact of stress on immune systems is mitigated.



**Figure 2:** Stress Management and Consequences



**Figure 3:** Applying Emotional Intelligence

## Neuroplasticity and Neurogenesis

Emotional Intelligence is a set of emotional, social, and relational skills that guides the way we perceive, understand, and express ourselves; connect with others; manage interpersonal exchange; cope with challenges; and apply emotional information in an effective, meaningful way. These skills are connected to changes in the brain through neuroplasticity, which is the ability of neural networks in the brain to change through growth and reorganization. These changes range from individual neurons making new connections to systematic adjustments like cortical remapping. Changes in the brain occur through neurogenesis, the process by which new neurons are formed in the brain. Neurogenesis is crucial when an embryo is developing but also continues in certain brain regions after birth and throughout our lifespan. Adult neurogenesis is the process in which neurons are generated from neural stem cells in the adult.

If you do what you have always done, you will get what you've always gotten. Learning and improvement lie in utilizing the developmental processes inherent within the brain for growth and self-management. Mindfulness is the process of self-awareness and deliberate management that serves to program the mind. 10 minutes of mindfulness practice a day can grow and measurably improve specific areas of the brain by as much as 25% in just eight weeks. Mindfulness leverages neuroplasticity and neurogenesis to build and rebuild the mind. When deliberate and focused, it creates a powerful impact.

## Putting it together in Healthcare

Effective healthcare leverages the emotions of patients, providers (community and support individuals), and professionals to collaborate for optimal recovery. The focus needs to be on experiences and relationships. Working in balance and harmony, human factors, soft skills and collaboration provide the emotional, mental and physical support for wellbeing, fitness, quality of life, and, when demanded, recovery.

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