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Exploring the Relationship Between Social Ties and Resilience From Evolutionary Framework

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This conceptual paper examines the necessity and importance of social bonds and networks in building resilience to fight the COVID-19. Resilience is a quality that energizes an individual's actions and acts as a buffer to stressful events. The current article is intended to explore the evolutionary programmed behavior of the human mind to make social ties and structure. Humans have a strong need to connect and relate with other individuals by developing cooperation and perspective-taking. The ability to make social connections, group living, and sharing resources had a selective advantage in coping with physical and psychological stress. Social bonds provide resilience to people's approach while making adjustments and adapting to situations, thus presents fitness benefits at both group and individual levels. An attempt has also been made to address how social isolation as a strategy to contain the infection adversely influence body homeostasis. Finally, this article recommends health practitioners, clinicians, and researchers to encourage research on the impact of social isolation/social interaction on mental and physical health indicators.

Keywords: social connections, COVID-19, stress, resilience, evolutionary process

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INTRODUCTION

The end of 2019 and the beginning of 2020 were marked by a worldwide outbreak of the COVID-19 pandemic. Coronavirus infection spread amongst the human population through droplet infections, contacting contaminated surfaces, and aerosols. The most effective strategy to contain the spread of the virus is to break the chain through social distancing, quarantine, hand hygiene, and wearing the mask (Saltzman et al., 2020). The nation-wise lockdown was imposed in various countries to contain the spread of coronavirus in March–April 2020. This global event has been tremendous in scale, with a far-reaching and profound impact on physical, psychological, social, economic, educational, and health systems across countries. The pandemic has shaken the world upside down with its nature and long-lasting effects, making us reflect on the integral and innate aspects of life. These aspects help us to survive, adjust, and function better in everyday situations. Social bonds and networks are one of those whose importance got highlighted. We acknowledge the significance of isolation during the pandemic. At the same time, there is a need to differentiate isolation without social interactions (as it happens in hospitals) and isolation at home (where an individual has interactional access with significant ones while following social distancing). In this article, we argue that isolation without social interactions may present short- and long-term undesirable effects on psychological and physical health. It is quite evident from the recommendation for home isolation given by several experts and governments (Mariani et al., 2020). In home isolation, the patient is not deprived of

social interactions. As a result, the patient receives necessary emotional and psychological care at home. In contrast, hospitals follow stringent protocols that disallow interactions from family members and relatives. Patients are isolated in a ward wherein there is the absence of emotional and psychological support, which, in turn, may delay recovery and adversely affect mental health (Cruces et al., 2014; Cacioppo et al., 2015; Holt-Lunstad et al., 2015; Campagne, 2019).

An exciting theme which the pandemic has presented is why the absence of social interactions is pivotal for human existence. In evolution, survival and reproductive success of species depend on the balance between benefits and costs. de Waal (2008) pointed out that consequences of behavior form the basis of evolutionary analysis. Behaviors producing desirable or undesirable effects are affected by environmental and contextual factors such as the number of members in a group, predators, climate, and competition. Social isolation is one such behavioral aspect that can positively or negatively affect health, depending upon several factors. Nevertheless, the notable point is that humans have developed and relied extensively on social relationships for inclusive fitness. Whether for a short or long period, social isolation may pose adverse fitness consequences (Bailey and Moore, 2018). Against this background, the current paper argues that the evolution of enriched sociality develops resilience capability in humans during the crisis, thus producing a beneficial impact on physiological and psychological health.

EVOLUTIONARY SIGNIFICANCE OF SOCIAL INTERACTIONS

Social interactions and networks play a major role in the survival of people. Throughout the process of evolution, the essential nature of social bonds has always been emphasized (Wilson and Williams, 2013). According to the evolutionary perspective, a socially isolated and lonely individual feels unsafe and tends to be highly sensitive to danger and attacks. To feel safe and protected, our ancestors formed social connections by working in groups, sharing food, and helping each other. In stressful situations or trauma, this ability has a selective advantage of survival (Cacioppo et al., 2006a) by weakening the effects of stressful experiences through these social connections (Cohen and Wills, 1985; Wolins and Wolins, 1993). Compared to several other species, humans are not physically strong and fast. Thus, humans have an extended infancy period and development occurs within different forms of social relationships that are hierarchical with strong in-group cohesiveness (Brewer, 2004). Hence, close connections with others helped fulfill the survival and reproductive needs of humans (DeWall et al., 2011).

To achieve the goal of fitness, individuals form social groups using social strategies (Dunbar and Shultz, 2007). People in groups receive physical and mental benefits contributing to their well-being (DeWall et al., 2011). Silk (2007) also explains that fitness benefits at the group level reach the individual because of relationships. Similarly, downward causation is about the social regulation of biology in which group living influences an individual's hormonal activity. For example, women living in close proximity for a significant period have coordinated menstrual cycles. The communal group living is essential for survival because it acts as a moderator between individual and environmental requirements. Humans' capacity to adapt to diverse physical environments results from the collective knowledge and cooperative information sharing. This capacity created obligatory interdependence (Caporael and Brewer, 1995), making it a process of genetic and sociocultural coevolution, thus suggesting that the survival chances of an individual are not only dependent on his or her abilities, skills, and efforts but also on the efforts and behavior of other related individuals within a social community (Brewer, 2004).

Another aspect of the evolutionary origin of social connections is anxiety related to the individual's awareness of his mortality. For our ancestors, not having social connections was equivalent to death and social exclusion induced existential worry (Koole et al., 2006) motivated people to form long-lasting and positive relationships. The drive for social connections is considered as a desirable trait fulfilling basic survival and reproductive goals and also reducing existential anxiety associated with awareness of death (DeWall et al., 2011). Conversely, social isolation may obstruct reproductive success. Isolation refers to separating oneself from other people, thereby inhibiting social contacts and activities. Harlow and Harlow (1962) found that isolated infant monkeys showed abnormal and compulsive behavior, self-aggression, emotional pathology, deviated sexual behavior, and less attention to conspecifics. In a study conducted by Li et al. (2016), socially isolated rats displayed impairment in cognitive functioning in the form of weakened prepulse inhibition. Judge (2010) found in a study on field cricket *Gryllus pennsylvanicus* that socially isolated females exercised less sexual selection on males relative to females having interactional access to members of the group. Humans, like other mammals, are socially interdependent and bonded to each other (Panksepp, 2005). The evolutionary explanation of depression focuses on separation distress - one of the primary mammalian emotional systems - involved in bonding and social attachment. It gets activated by incidences of separation in infancy and early childhood and motivates reunion seeking, which supports maintaining social bonds (Watt and Panksepp, 2009).

Using Behavioral Immune System (BIS) theory, Brüne and Wilson (2020) argued that humans evolved several defense mechanisms such as avoidance of interpersonal and social interactions, neophobia, and isolating or rejecting sick individuals during the time of infection. While agreeing with the argument, it is also imperative to understand that infectious diseases in human history had not been overcome by merely following social isolation or social rejection. Instead, contagious diseases were controlled by integrating the efforts of medicine development and community participation and support. Here, as mentioned previously, we make a distinction between self-imposed isolation and social isolation. Self-imposed isolation does not preclude social interactions while simultaneously adheres to social distancing. Bailey and Moore (2018) suggested that self-imposed isolation could provide adaptive benefits to fight off pathogens.

SOCIAL INTERACTIONS, RESILIENCE, AND HEALTH

Social connections and support are causal components of resilience. Social connections and interactions help individuals to deal with stressful situations, come out of the adverse conditions and display adaptive capacity (Marsh, 1996; Fuller-Iglesias et al., 2008; Masten, 2014). Social connections within and between diverse groups indicate recovery from personal and community level traumas by showing the resilience quality. It can be seen in the communities with the history of volunteerism, having evolved a structure of mutual trust and self-help, thus supporting people to live through the crisis (Wilding, 2011). According to Houston and Buzzanell (2018), social connections and support promote coping behavior and psychological adaptation to emerging situations.

Post disasters, resilience can be seen as an outcome of social support (Xu and Ou, 2014; Saltzman et al., 2018). Thus, while experiencing stress and trauma, social networks become crucial to promoting resilience (Sippel et al., 2015). In resilience, an individual's traits, family, and social environment act as protective factors (Werner and Smith, 2001). Studies revealed that social support meets informational, material, and emotional needs that help building up mutual trust, interpersonal care, and shared space (Marsiglia et al., 2002; O'Donnell et al., 2002; Gralinski-Bakker et al., 2004; LaFromboise et al., 2006; Jones, 2012).

A strong association between resilience and interpersonal connections highlights the importance of social relationships for positive health outcomes. Castro and Zautra (2016) found that strong relations elicit effective short-term responses to stress and lower overall pressure exerted on the body by the process of adaptation. It suggests that social connections and relations work at the psychological, physical, and community levels in the time of stress, adversities, and traumas to help people deal with challenging and uncertain times and build resilience during this adaptation process. Also, these connections and relations let people enjoy fitness benefits at both the group and individual level (Luthar, 2006).

Deprivation of social relations causes serious physiological and psychological disturbances, making individuals weaker and incapable of facing stress and adversities effectively. Mariani et al. (2020) and Nathiya et al. (2020) found that family support enhances psychological coping strategies during the pandemic.

American Psychological Association has acknowledged the importance of social support as a response to COVID-19 (American Psychological Association, 2020). Literature has also pointed out the broader role of social support in decreasing negative symptomatology and encouraging positive adaptation post-COVID-19. Similarly, Psychological First Aid (PFA) and Skill for Psychological Recovery (SPR)—first-line disaster interventions—have also emphasized social support as a mechanism of coping (Ruzek et al., 2007; Wade et al., 2014). However, COVID-19 management demands social distancing, so it is required for people to change their ways of making connections and methods to stay connected (Saltzman et al., 2020), which would enhance a resilient response to the situation.

The lack of social interactions and unfulfilled personal and social needs cause loneliness (Cacioppo et al., 2006b; Grossman et al., 2020). Loneliness develops social pain, which is neurocognitively similar to physical pain (Eisenberger et al., 2003), thus leading to low self-esteem, declined feelings of control, and depression (Van Orden et al., 2010; Vanhalst et al., 2012; Beutel et al., 2017; Wang et al., 2018). Literature suggests that an unpredictable chronic mild stress (during the pandemic) followed by social isolation, whether objective or subjective, and inadequate social support increases morbidity, mortality, major depressive disorder, suicidal ideation, and suicide attempts (Lau et al., 2005; Cacioppo et al., 2006b; Kessler et al., 2006; Mak et al., 2009; Holt-Lunstad et al., 2015; Beller and Wagner, 2018; Wang et al., 2018; McClelland et al., 2020; Moccia et al., 2020; Sani et al., 2020).

Giallonardo et al. (2020) showed that quarantine also leads to frustration, loneliness, and worries about the future. This causes fear and errors in risk perceptions, thus leading to negative societal behavior (Shigemura et al., 2020). Particularly in COVID-19–positive patients, the experience of hospital isolation and perceived danger, uncertain physical conditions of self, and fear of dying act as risk factors and develop the symptoms of anxiety, depression, and PTSD (Bo et al., 2020; Xiang et al., 2020).

Break in social bond with the fear of losing occupation, contacting the viral infection, and restricted movements might hyperactivate the stress axes, which, in turn, adversely affect the physiological systems, including immunity (Matthews et al., 2015; Courtin and Knapp, 2017; Taylor et al., 2018; Smith and Victor, 2019), resulting in a high degree of fatality in comorbidity cases (Holt-Lunstad et al., 2015; Beller and Wagner, 2018; Boyraz et al., 2020). Conversely, interpersonal interaction and social connectedness help individuals overcome post-pandemic socioeconomic and mental health complications (Boyraz et al., 2020).

Social isolation impacts all age groups of the population. In children, lack of face-to-face interactions with peers and friends and limited outdoor activities psychologically affect them adversely. It is reflected in the form of loneliness, distress, anxiety, depression, and self-harm or suicide (Elovainio et al., 2017; Matthews et al., 2019; Galea et al., 2020; Brooks et al., 2020; Pfefferbaum and North, 2020; Wang et al., 2020). COVID-19–related loneliness can have an intensified impact on adolescents and young adults (Beam and Kim, 2020). A strong association was found in older adults between social isolation and behavioral symptoms like sleep disturbance and fatigue (Cho et al., 2019).

Further, social isolation poses a detrimental effect on human physiology. Research studies have stated the significant association between social isolation and diseases such as coronary heart disease (CHD) (Orth-Gomér et al., 1993) and memory loss (Ertel et al., 2008). The loneliness that comes with social isolation shows a significant association with cardiovascular diseases, diabetes, migraine, and sleep problems (Christiansen et al., 2016). According to Seeman et al. (1987), long-standing stress and

lower coping resources related to social isolation are responsible for immune and neuroendocrinal changes. Similarly, social isolation itself also acts as a stressor causing prolonged elevations in the hypothalamic–pituitary–adrenal (HPA) axis and sympathetic nervous system (SNS) activation (Cacioppo et al., 2015). These systems regulate the functions of various internal bodily systems for better immune functioning. The following section covers, in detail, the relationship between social isolation, stress, and physiology.

PHYSIOLOGY OF STRESS AND STRESS RESPONSES

Studies in the context of COVID-19 unanimously underline that social isolation increases the stress level in humans. An important aspect of stress resistance is the functioning of human physiology during stress. Physiological and psychological components are symbiotically related to each other. Hence, the understanding of human responses during COVID-19 requires a description of physiological responses and how it affects psychological functioning. Any environmental, physiological, and psychological stimulus that disharmonizes the homeostasis of an organism is perceived as stress (Drolet et al., 2001; Beery and Kaufer, 2015; Mumtaz et al., 2018). The stress-induced neurosensory signals are perceived and processed in the parts of the brain locus coeruleus (LC) and paraventricular nuclei (PVN) of the hypothalamus (Charmandari et al., 2005). To reestablish the homeostatic state, the body responds to these stressors *via* activating hypothalamic–pituitary–adrenal (HPA) and sympatho-adreno-medullary (SAM) axes (Charmandari et al., 2005). The stress stimuli elicit the release of corticotropin-releasing factor (CRF) and vasopressin (VPN) from PVN of the hypothalamus, which, in turn, stimulates the production of proopiomelanocortin-derived peptides, enkephalins, endorphins, and adrenocorticotropic hormone (ACTH) in the pituitary (Schulkin et al., 1994; Drolet et al., 2001; Goeders 2002; Dallman et al., 2003; Charmandari et al., 2005). ACTH further acts on the adrenal cortex and stimulates the production of glucocorticoids, corticosterone in rodents, and cortisol in humans. Moreover, the CRF stimulates the production of norepinephrine in the sympathetic nervous system and the peripheral tissues. The stress-response mechanism in animals has been designed to prepare the organisms to cope with the stress through "flight or fight" responses. While the stress-mediated increase in plasma glucocorticoid level raises blood glucose level, an increase in norepinephrine level stimulates cardiac output, rate of respiration, heartbeat, and blood flow, and thus prepares the organism to cope with the stress through the "flight or fight" mechanism (Charmandari et al., 2005). However, prolonged stress responses, as observed in chronic stress, adversely affect various physiological functions, including immunity, and thereby make the organism vulnerable to multiple metabolic diseases and potential infections (Dallman and Bhatnagar, 2010).

Depending upon the type of stressor, different parts of the brain are activated during stress. Physical stressors like blood loss, trauma, and cold temperature activate the brainstem and hypothalamic regions (Reiche et al., 2004). On the other hand, psychological stressors like social embarrassment, examination, deadlines, and social isolation involve the activation of the amygdala, prefrontal cortex, and hippocampus for controlling emotions, learning, memory, and decision-making (Reiche et al., 2004). About chronic restriction movement and social isolation, stress-mediated increase in norepinephrine and serotonin level in PFC cause anxiety, learning disability, and depressive behavior (Reiche et al., 2004). It further results in suboptimal physiological functioning and impaired immune functions.

The social behavior of animals ensures better survival chances through reproductive success, protection from predators, and environmental factors (Neumann, 2009). First evolved in insects, the complex and coordinated social behavior is observed in mammals, including humans (Neumann, 2009; Blumstein et al., 2010; Ebensperger et al., 2012). The social lifestyle, in general, ensures optimal functioning of the neural, endocrine, and immune system, that, in turn, maintains a homeostatic state, reduces anxiety and depression, promotes proper cardiovascular and immune functioning and thus life expectancy (Taylor, 2006; Taylor et al., 2007; Neumann, 2009; Blumstein et al., 2010; Ebensperger et al., 2012; Beery and Kaufer, 2015). On the contrary, social isolation-induced psychological stress disturbs the coordinated functioning of neural, endocrine, and immune functions (Cruces et al., 2014). Consequently, hyper- and prolonged activation of the stress axis (HPA) causes fluctuation in the blood pressure, sleep impairment, anorexia, reduced cognitive and behavioral responses, compromised immune system (Cruces et al., 2014), and thus increased chances of comorbidity.

Chronic stress responses marked with increased production of catecholamines, opioid peptides, and glucocorticoids adversely affect the immune functions. Numerous experimental evidences support that glucocorticoids, catecholamines, and opiate peptides at elevated levels suppress both innate and adaptive immune functions (Reiche et al., 2004; Cruces et al., 2014). It has been reported that social isolation adversely affects both innate and adaptive immune systems (Cruces et al., 2014), making individuals susceptible to potential infections. Studies pertaining to address the effect of social isolation on the HPA axis and body homeostasis have been widely explored in diverse animal species, including mammals. Moreover, the responses of individuals to stress are influenced mainly by age, sex, species type, isolation regimen, and type of stressor (Hawkley et al., 2012). While chronic isolation stress increased the plasma corticosterone level in rat, mice, hamsters, pigs, and cattle (Creel and Albright, 1988; Detillion et al., 2004; Dronjak et al., 2004; Weiss et al., 2004; Hermes et al., 2006; Grippo et al., 2007a; Grippo et al., 2007b; Kanitz et al., 2009; Williams et al., 2009; Weintraub et al., 2010; Ferland and Schrader, 2011; Toth et al., 2011), in nonhuman primates such as marmosets (Cross et al., 2004; Smith et al., 2011) and rhesus monkey (Higley et al., 1992), it causes the increased production of cortisol. Though glucocorticoids support the body physiology under stress conditions, prolonged exposure to stress causes adverse effects, including compromised immune responses, and hence increased vulnerability to infections.

IMPLICATIONS AND FUTURE RECOMMENDATIONS

The first implication is clinical intervention. In hospitals, patients can be given access to meet family members and friends by following social distancing norms. This will strengthen their mental health and enhance the coping behavior. The second implication is that systematic studies should be conducted on recovery from COVID-19 under home and hospital isolation. Although there is no data available, the encouragement given to home isolation by health experts makes it a better strategy to recuperate from the disease. Home isolation provides relational access to patients, thereby substantially limiting the deleterious effect of complete social isolation. Third, experimental studies should be conducted to test the varying levels of isolation on health. As mentioned in the article, isolation leads to psychological and physiological changes adverse to mental health, reduces immune responses, and brings disruption in neural and endocrinal activity. This can be done by creating three conditions: home isolation, hospital isolation, and hospital isolation with some interactions following social distancing. Researchers, then, can test whether there is a significant difference in the psychological and physiological parameters in these three groups.

AUTHOR CONTRIBUTIONS

SA and SK contributed to the manuscript's writing as per the design and conception of the work formulated by RR. SA has written about the psychological aspects of social isolation and social interactions. SK has written about the physiological implications of social isolation and physiological responses to stress.

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