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Attachment Network Structures and Adult Mental Health

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ATTACHMENT NETWORK STRUCTURES AND ADULT MENTAL HEALTH

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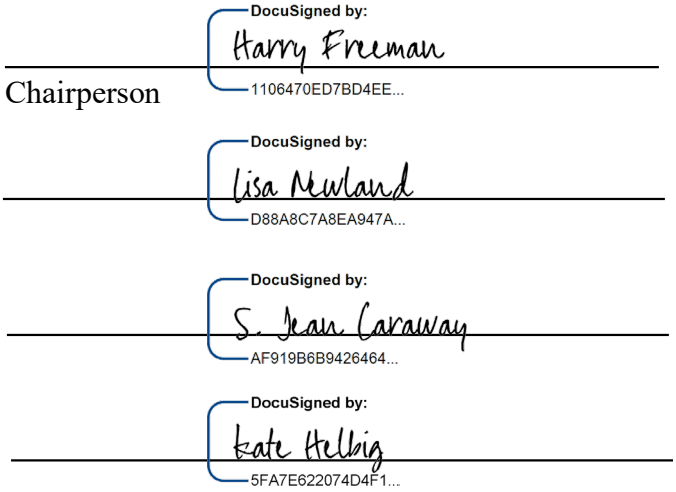

ABSTRACT

Close relationships are essential to the mental health and adaptation of adults. The study of close relationships and mental health has concentrated on dyadic interactions in different types of relationships, such as parents, best friends, and romantic partners. Much less attention has focused on how a network of close relationships informs mental health. This study concentrated on a network of five close relationships in relation to adult mental health outcomes. Four network metrics, which are composition (who), strength (number of attachment figures), morphology (hierarchical or nonhierarchical), and physical proximity were examined as predictors of adult mental health outcomes (i.e., depression, anxiety, and suicidal ideation). Each network metric was investigated based on different age groups and attachment quality as potential moderating factors to explore whether the network structures of close relationships can be considered as a possible factor for understanding adult mental health. Participants included 930 adults (57% female) aged from 24 to 80, who first completed the Web-based Hierarchical Mapping Technique (WHMT), a diagrammatic measure of attachment network composition, strength, morphology, and physical distance. After completing the WHMT, the participants also completed a Qualtrics survey that included extensive questions on their demographics, mental health scales, and attachment relationships. Furthermore, the participants completed the Patient Health Questionnaire (PHQ-9), General Anxiety Disorder (GAD-7), and the Suicide Behaviors Questionnaire-Revised (SBQ-R) to assess depression, anxiety, and suicidal ideation. They also completed Experiences of Close Relationships-Revised-General Short Form (ECR-R-GSF) to examine attachment quality. Multivariate Analysis of Covariance (MANCOVA) and Hierarchical Multiple Regression (HMR) were employed to explore how each network indicator was related to differences in the three mental health outcomes. The findings provided some confirmation that choosing different primary attachment figures were not significant to mental health outcomes in adult attachment networks. Having more attachment figure was associated with positive mental health outcomes. Contrary to study hypothesis, participants with non-hierarchical networks reported better mental health outcomes. Additionally, the amount of physical distance from close relationships did not appear to be a good predictor of mental health.

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Chapter One: Introduction

Background

According to recent educational and psychological research, the mental health needs of both adolescents and adults have become a national focus of attention in the United States during the past decade (Prince, 2015). A growing number of people have been experiencing depression, anxiety, and suicidal thoughts in the United States (Czeisler et al., 2020; Kumar et al., 2013; Toscos et al., 2019; Young et al., 2016). Nevertheless, depression and anxiety are two of the most popular mental health problems or disorders during adolescence and adulthood (Costello et al., 2006; Williamson et al., 2005). Mental health illnesses negatively influence people's life, work, study, and impact their relationships, which may place individuals at an increased factor for suicidal ideation (Goldston et al., 2009; Kumar et al., 2013; Mayes et al., 2014). Some studies have demonstrated a connection between adolescent attachment networks and their mental health outcomes (Berkman et al., 2000; Bowlby, 1980; Bretherton, 1991; Lee, 2012; Porter & Chambles, 2014; Rosenthal & Kobak, 2010). However, it is not completely clear whether network structures in close relationships are linked to the results of adult mental health (Doherty & Feeney, 2004, Freeman et al., 2018, 2021). In addition, existing measures focus on a single metric (i.e., composition), and additional metrics (i.e., strength, morphology, and physical proximity) need to be examined in order to better explore the whole picture of networks for close relationships (Rowe & Carnelley, 2005). Visualized diagrammatic assessments that measure social networks for close relationships may be helpful as an effective way to investigate internalizing problems with the adult population. Nevertheless, the empirical evidence to support

the association between attachment network structures and adult mental health outcomes is needed.

Problem Statement of the Study

The study of close relationships and mental health for adults has received increasing interest and attention among researchers during the past decade (Chopik, 2017). Close relationships are characterized by strong and enduring interdependence, which is defined as the extent to which intimates need and influence one another (Dunkel Schetter, 2017). Pietromonaco and Collins's (2017) research has suggested that close relationships play a vital role in people's mental health. Moreover, close relationships can protect and promote health in different ways (Feeney & Collins, 2015). Supportive close relationships promote health both by helping people cope with stress and by enabling them to fulfill basic needs for social connection such as love, intimacy, companionship, and security (Pietromonaco & Collins, 2017). However, Umberson and Montez (2010) have also demonstrated that strained and conflicted social interactions undermine health. For instance, negative social interactions and close relationships, especially with partners or spouses, increase the risk and probability of depression, anxiety, and suicidal ideation (Coker et al., 2002). In summary, close relationships are integral and essential to the mental health and adaptation of adults (Dunkel Schetter, 2017). Nevertheless, the impact of relationships on mental health has concentrated on dyadic interactions in different types of relationships, such as parents, best friends, and romantic partners (Daley & Hammen, 2002; Pietromonaco & Uchino, 2013). Much less attention has focused on how a network of close relationships informs mental health, which is the focus of the current study (Pietromonaco & Powers, 2015).

Networks of close relationships can be defined as strong emotional or relational bonds between a finite number of people (e.g., family members, friends, peers, romantic partners) (Mason et al., 2014). In the current study, I will focus on the five closest relationships in one's social network that include one's attachment relationships. Attachment relationships identify a special class of affectionate bonds that are biologically based and function to provide felt security. Most children, adolescents, and adults typically have between one and four attachment relationships (Freeman & Simons, 2018; Freeman et al., 2021). Four different metrics of network structure will be measured and used to predict adult mental health; these include (1) composition, 2) strength, 3) morphology, and 4) physical proximity.

Composition of the network refers to who is in the network. The majority of research on attachment networks has focused on this single metric of who people are attached to. Strength of network indicates a measure of how close each relationship is to the person. Network strength can be compared between people as a measure of absolute strength, but it can also be compared within subjects as relative strength between network members. Relative strength can be used to understand the shape or morphology of the network; for instance, if the network is hierarchical or not. Compared to adolescent networks, few network analyses have examined variations in the strength of adult close relationship networks (Allen, 2008; Kobak et al., 2005). Morphology of the network describes the relative strength of a network through five closest network figures (the degree to which network members are hierarchically organized or not). Morphology of the network can be nonhierarchical (distributed structure-no preference) or may take on different forms of hierarchical structure such as monotropic (a primary figure), diversified (differentiation between a primary and secondary figure and between a secondary and tertiary figure) or joint principal (no difference between top two figures) (Freeman & Simons, 2018). The fourth metric

is physical proximity, that is, the physical distance and geographical location of each member of the network in relation to each other. Overall, the four key facets of network structure (strength, composition, morphology, and physical proximity) provide a framework for conceptualizing how adults organize multiple attachment bonds with parents, romantic partners, peers/friends, and others (Freeman & Simons, 2018). Each network metric will be examined based on different age groups and attachment quality as potential moderating factors to explore whether the network structures of close relationships can be considered as a possible factor for understanding adult mental health.

Existing studies of close relationship networks provide a limited or incomplete understanding. Most studies have focused on a single metric of network structure and explored attachment strength using ordinal or ranking items. The ranking scales are fit for the identification of the composition in attachment networks and the primary attachment figures. Nevertheless, the ordinal scales are not able to indicate an accurate measurement of attachment strength and within-subject comparisons between network members (Freeman & Simons, 2018; Freeman et al., 2021). Based on Doherty & Feeney's study in 2004, they assessed the structure of adult attachment networks and used a questionnaire measure of preferred attachment figures with a great number of adult participants representing a wide age range and life situations (Doherty & Feeney, 2004). Goh & Wilkinson (2017) used the Attachment Network Questionnaire to examine attachment strength and relationship expectancies in the prediction of adolescent stress and depression. Attachment strength was found to demonstrate fewer associations with psychological health in the presence of individual differences in attachment expectancies and did not consistently predict adolescent psychological health.

Although the field has gained an understanding of the normative structure of attachment networks at different ages, traditional analyses and scales are not capable of examining variations or differentiations in the attachment strength or shape of the network (Freeman & Simons, 2018; Rowe & Carnelley, 2005). In addition, very little is understood on how the composition of adult attachment networks will change based on current assessments and methods. Unfortunately, the data on adult attachment at different ages have been ambiguous, and as a result, alternative theoretical perspectives have evolved to explain them (Fraley et al., 1997, 2006). Based on limited study of adult attachment networks in the United States, few studies have used multi-dimensional network indicators to examine how mental health is situated within multiple ongoing relationships.

The current research provides a more complete view of how our closest relationships are important to adult mental health outcomes by examining the relationships between four attachment network metrics (composition, strength, and morphology, and physical proximity) in relation to mental health. A second focus in the current study is to examine the quality of attachment as a moderating variable of the connection between adult network structures in close relationships and mental health. Other potential moderating effects between attachment network structures and adult mental health are also be investigated (i.e., age and attachment quality). Furthermore, based on the Web-based Hierarchical Mapping Technique (WHMT), the WHMT can be applied for independent ratio-scaled ratings of network figures and is designed to address four attachment network metrics: composition, strength, morphology, and physical proximity. It is also a new measure of attachment network composition and strength and an alternative method to traditional assessment measures of attachment with multiple advantages. (Freeman et al., 2021).

Chapter Two: Literature Review

Overview

This chapter first includes a review of pertinent research that is related to close relationships and mental health. Second, the association between attachment theory and attachment networks is discussed. Third, the connection between attachment networks and mental health is presented. Fourth, an outline of the interrelationship between the four metrics of attachment networks with adult mental health, especially in anxiety, depression, and suicidal ideation is introduced and discussed. Lastly, a chapter summary is provided.

Close Relationships and Mental Health

Close relationships are significant to people's mental health (Kawachi & Berkman, 2001; Ross et al., 2019). Positive intimate relationships (e.g., family relationships, romantic relationships, and close friendships) can provide individuals with emotional, practical, and social support and reduce feelings of loneliness and social isolation (Cohen, 2004; Hefner & Eisenberg, 2009; Rook, 2015). In contrast, people who report negative close relationship experiences (e.g., conflict, abuse, and lack of support) have higher rates of anxious and depressive symptoms, suicidal ideation, and cardiovascular disease in dysfunctional family relationships, abusive romantic relationships, and toxic friendships (Brooks & Dunkel Schetter, 2011; Ibarra-Rovillard & Kuiper, 2011; Rueger et al., 2016).

Social connection is considered a crucial aspect of close relationships, as it helps to build and maintain the emotional bond between individuals (e.g., family members, romantic partners, friends) (Kawachi & Berkman, 2001; Martino et al., 2017). In close relationships, social connection has been explored by researchers through a variety of ways. The key constructs of social connection consist of social isolation, loneliness, the feelings of vulnerability, and the

quality of relationships, which have significant impacts on people's mental health. These components are discussed below.

First, a lack of social connection in close relationships can lead to the feelings of loneliness and social isolation (Holt-Lunstad et al., 2010). Social isolation and loneliness have been discussed by a lot of studies in the aspects of mental health, which can negatively influence mental health (e.g., mortality and morbidity-depression, anxiety, suicidal thoughts) in children, adolescents, and adults (Courtin & Knapp, 2017; Gerst-Emerson & Jayawardhana, 2015; Holt-Lunstad et al., 2010, 2015, 2016; Loades et al., 2020). Social isolation refers to the situation or the state that people completely lack or lose social interactions, contacts, or supports, which is closely associated with the quality and quantity of social relations (Holt-Lunstad et al., 2010, 2015, 2016; Veazie et al., 2019). The state of social isolation can include staying at home for a long period of time without any connection or contact with family members or friends and avoiding contacts with others intentionally (Cudjoe et al., 2020; House, 2001; Lacey et al., 2014; Qualter et al., 2010). Moreover, social isolation can happen in any age group, but different age groups may have various symptoms (e.g., anxiety, depression, suicidal ideation, lethargy, poor self-care) (Cudjoe et al., 2020; House, 2001; Lacey et al., 2014; Qualter et al., 2010). Many relevant studies have indicated that individuals who are socially isolated are likely to have higher suicidal tendencies (more easily to commit suicide) than those who are strong socially connected, especially for young adults (Cudjoe et al., 2020; House, 2001; Lacey et al., 2014; Qualter et al., 2010). Nevertheless, social loneliness is different from social isolation, which describes the subjective emotional state that people may temporarily lack social communications or interactions and feel alone or isolated. It should be noted that individuals have inadequate social contacts or interactions in the state of loneliness (Holt-Lunstad et al., 2010, 2015, 2016; Veazie

et al., 2019). Loneliness also influences mental health. Related research has found that adolescents who have experience of loneliness in peer relationships or friendships (peer-related loneliness) are more likely to feel depressed since less support came from their peers or friends (Lau et al., 1999; Qualter et al., 2010).

Social isolation is measured by most studies through different social network indexes, including frequency, size, closeness of interactions or contacts of an individual's social networks (Chan et al., 2017; Veazie et al., 2019). These factors are based on the assessment of the level of contact and support that people can get from their family members, friends, and others (Chan et al., 2017; Veazie et al., 2019). Most isolation studies use self-report ordinal or ranking scales to examine social isolation (i.e., an individual's perceived level of social isolation), such as Lubben Social Network Scale and the Revised Social Isolation Scale (Holt-Lunstad et al., 2015; Valtorta et al., 2016). Loneliness is measured by examining emotional and social loneliness, which is also based on ordinal or ranking scales (Chan et al., 2017; De Jong Gierveld & Havens, 2004; Veazie et al., 2019). These scales include De Jong Gierveld Loneliness Scale, UCLA Loneliness Scale, Social Provisions Scale, and Social Support Questionnaire (i.e., an individual's subjective feelings of loneliness) (De Jong Gierveld & Havens, 2004; Valtorta et al., 2016; Veazie et al., 2019).

Second, lack of social connection is also linked to feelings of vulnerability. Vulnerability is described as one's feeling of emotional exposure to negative outcomes (i.e., susceptibility) or the sense of insecurity (being unprotected) from dangerous situations and harmful experiences (Haddadi & Besharat, 2010). Individuals who lack social connection are tended to be more vulnerable to depression, anxiety, distress, antisocial and suicidal behaviors, which may cause an increase in their isolation (Cacioppo & Patrick, 2008; Haddadi & Besharat, 2010). Based on the

neurobiological evidence, vulnerability activates stress responses, which releases stress hormones such as adrenaline and cortisol (Kumar et al., 2013). Some research has demonstrated that when people feel vulnerable, a stressful situation (no matter from environmental or psychological perspective) can activate a series of stress hormones that cause physiological changes (Chu et al., 2021). Additionally, negative mental health outcomes in children and adolescents are closely relevant to stress and the repeated activation of the stress response system (Rotenberg & McGrath, 2016).

Finally, relationship quality (the quality of connection) is the factor that cannot be neglected as well in close relationships for people's mental health (Cohen, 2004; Rook, 2015). The quality of relationships describes how individuals are satisfied with their relationships, which is closely associated with positive and negative feelings about relationships (Farooqi, 2014; Morry et al., 2010). Relationship quality involves various aspects, such as trust, satisfaction, and feelings of safety (Berry & Worthington, 2001; Farooqi, 2014). High quality in a relationship reflects in positive feelings or experiences such as well-being, affection, and intimacy, while low quality of a relationship is embodied in negative feelings or experiences such as conflicts and interferences (Berry & Worthington, 2001; Dush & Amato, 2005; Farooqi, 2014). Some current research on relationship quality and mental health is mainly focused on the pandemics of COVID-19. Pieh et al., (2020) created a cross-sectional study and evaluated the differentiations of mental health and well-being measures in terms of relationship quality during COVID-19. The findings suggested that poor relationship quality might cause more depression and anxiety symptoms than better relationship quality. A relationship itself was not connected with mental health outcomes, but the quality of a relationship was crucial to mental health. Pieh et al., (2021) also investigated the association between the quality of relationships and mental

health during COVID-19 in the UK. The results demonstrated that the high quality of relationships was positively associated with the results of mental health and well-being, including lower stress and depression. However, those people who had worse quality of relationships were more burdened and drank more alcohol during COVID-19 lockdown.

As discussed above, four dimensions of social connection (i.e., social isolation, loneliness, the feelings of vulnerability, and the quality of relationships) in close relationships are indispensable to one's mental health, but these constructs have been approached only based on a non-network perspective. A network perspective of close relationships can provide a panorama of an individual's social connections and relationships. This can give researchers a more comprehensive understanding of how close relationship networks are associated with mental health outcomes. This study will provide a more complete picture by examining the ecology of close relationships from an attachment perspective.

This study will focus on four attachment network indicators: composition, strength, morphology, and physical proximity. The rationale of this research is to keep the concentration of the study on variables which associate with attachment network structures and their relationships to the outcomes of adult mental health.

Attachment Theory and Attachment Networks

Attachment theory was pioneered by John Bowlby (1969, 1982) and further developed by his student, Mary Ainsworth (1967, 1989). The theory is focused on a strong and emotional bond or connection between infants and their caregivers (e.g., mothers, fathers, others) (Bowlby, 1969). Generally, parents (usually the mother) are the baby's initial primary attachment figure during the first year of life (Ainsworth, 1991; Bowlby, 1969, 1982; Cassidy & Shaver, 2008). Infants are not able to survive on their own, and their attachment behavior is considered as

survival adaptation (Bowlby, 1982). The construct of attachment delineates the attachment behavior that people usually seek to maintain proximity to significant others for comfort and protection when they feel vulnerable and distressed (Bowlby, 1982). Internal working model (IWM) is an essential concept in attachment theory and was elaborated by Bowlby (1969, 1982). The model indicates a mental representation that is shaped through children's early experiences with their primary caregiver (Main et al., 1985). The mental representation is closely associated with attachment experiences, which impacts how children interact and establish relationships with other people as they grow up (Main et al., 1985). People's attachment interactions are influenced by their formation of the working model (Bowlby 1973; Bretherton & Munholland, 2008).

The process of attachment formation to first attachment figure(s) involves four basic stages (Ainsworth, 1991; Bowlby, 1969, 1982; Cassidy & Shaver, 2008). The first stage is called the pre-attachment phase. From birth to six weeks, babies do not particularly attach to a specific caregiver, but their signals or behaviors (e.g., crying, gazing, smiling) can naturally draw the attention of the caregiver (Ainsworth, 1991; Bowlby, 1969, 1982; Cassidy & Shaver, 2008; Mikulincer et al., 2003). Although babies do not feel anxious if they are left with a stranger, they still can identify and distinguish their own mother's voice, face, or smell. At six weeks to six to eight months, infants start to move from pre-attachment to attachment-in-the-making phase. Based on Bowlby, infants are able to show their preference for primary and secondary attachment figures (caregivers) during this stage (Ainsworth, 1991; Bowlby, 1969, 1982; Cassidy & Shaver, 2008; Mikulincer et al., 2003). According to the infant's relationships with the attachment figures, infants can recognize and respond differently between familiar caregivers and strangers. Some research has demonstrated that babies are inclined to use signals such as

smiles and babbles to interact with their mother, and they can be quiet more quickly when their mother picks them up (Ainsworth, 1991; Bowlby, 1969, 1982; Cassidy & Shaver, 2008; Mikulincer et al., 2003). As babies identify and learn that their own behaviors influence the people who are around them, they begin to build a sense of trust with their caregivers in the attachment-in-the-making phase (indiscriminate stage). Infants show some discrimination at this stage, but it is emerging. Infants will still not show strong protest for particular caregivers. Anxiousness and protest are present, but emerging qualities that become more fully recognized in the next stage. After indiscriminate stage, infants begin to move into clear-cut attachment phase (discriminate stage) between eight months to two years, and they can display strong attachment to a clear or specific attachment figure (Ainsworth, 1991; Bowlby, 1969, 1982; Cassidy & Shaver, 2008; Mikulincer et al., 2003). Attachment to the first attachment figure(s) is obvious, and the familiar caregiver is considered as the infant's secure base. Separation anxiety is also shown during this stage. Generally, separation anxiety gradually increases between six and fifteen months. Infants become upset and anxious when their attachment figure(s) leaves (Ainsworth, 1991; Bowlby, 1969, 1982; Cassidy & Shaver, 2008; Mikulincer et al., 2003). Formation of a reciprocal relationship is developed after the discriminate stage, and infants begin to grow emotional and attachment bonds with other attachment figures (caregivers). As the infant forms additional attachments to other caregivers, there is the formation of an attachment network (Ainsworth, 1991; Bowlby, 1969, 1982; Cassidy & Shaver, 2008; Mikulincer et al., 2003).

Nevertheless, very little is understood about how networks function in infancy and childhood since the focus has been on the mother-child relationship. The focus on the mother-child relationship limits researchers' understanding of the role of other relationships and

networks in shaping early development and mental health. (Dagan & Sagi-Schwartz, 2018; Kochanska, 1998; Laible & Thompson, 2000).

Attachment Relationships and Mental Health

Of all people's relationships, attachment relationships are most important. Attachment relationships identify a special class of affectionate ties that are biologically based and function to provide felt security (Ainsworth, 1967). Most children, adolescents, and adults typically have between one and four attachment relationships (Freeman & Simons, 2018; Freeman et al., 2021). These relationships play an essential role in shaping an individual's mental health. Relevant study has indicated that early childhood experiences with attachment figures can have a lasting impact on mental health, as they shape an individual's attachment style and their ability to form and maintain close relationships in adulthood (Bowlby, 1980, 1988; Bretherton, 1992; Fonagy et al., 2014). Individuals with a secure attachment style are characterized by trust and confidence in their attachment figures and tend to have better mental health outcomes compared to those with insecure attachment styles, such as avoidance or anxiety (Bowlby, 1980, 1988; Mikulincer et al., 1999).

However, the existing research on attachment has also demonstrated that a lack of attachment or insecure attachment can potentially cause emotional dysregulation (Marganska et al., 2013; Mosquera et al., 2014). Those people who do not have a secure attachment may have difficulty in managing their emotions when they feel stress, anxious, or vulnerable. This can lead to emotional outbursts or mood swings (Mikulincer et al., 2006). Moreover, if individuals are not able to get sufficient emotional support, they may also struggle to control their emotional responses to interpersonal relationships and social situations (Elhusseini et al., 2023). This can cause difficulty in forming and maintaining healthy relationships (i.e., loneliness and social

isolation). Individuals who lack attachment may also struggle with self-worth and self-esteem and leading to negative thoughts and emotions (Brennan & Morris, 1997; Park et al., 2004). This can lead to a vicious cycle of negative emotions and difficulty in regulating their emotional responses to different events and experiences (Brennan & Morris, 1997; Park et al., 2004).

In addition, attachment quality, as one of the important areas of relationship quality, is also closely associated with mental health (Mikulincer & Shaver, 2012). Attachment quality indicates the unique and typical modes of correlative expectations in terms of major attachment patterns (secure vs insecure) that reflect mental representations of self and significant others (Mayseless, 1996; Mikulincer et al., 2003). The quality of attachment is closely related to specific caregivers and largely determined by the caregiver's responses. Insecure attachment can be seen as a general vulnerability to mental disorders (Lieberman, 2004; Mikulincer & Shaver, 2012). Attachment insecurities (i.e., anxious and avoidant attachment) are connected with depression, clinically significant anxiety, suicidal ideation, and post-traumatic stress disorder (PTSD) (Bosmans et al., 2010; Cantazaro & Wei, 2010; Ein-Dor et al., 2010; Gormley & McNiel, 2010). Additionally, some research has suggested that the secure attachment relationship between babies and their mother predicts a better cognitive and behavior outcome; however, insecure attachment, especially for anxious-resistant attachment, may cause lower cognitive level and greater behavioral problems in early childhood (Ainsworth, 1989; Ding et al., 2014).

Attachment Relationships and Social Isolation and Loneliness

As discussed earlier, a lack of social connection in close relationships can cause the feelings of social isolation and loneliness. The existing study on attachment has also discussed about social isolation and loneliness from the perspective of attachment relationships (De Jong

Gierveld et al., 2006; Mikulincer & Shaver, 2013, 2021; Weiss, 1987). Moreover, some researchers prefer to call social isolation and loneliness in attachment relationships as emotional isolation and loneness (De Jong Gierveld et al., 2006; Mikulincer & Shaver, 2013, 2021; Weiss, 1987). Attachment figures play a crucial role in adolescent and adult attachment networks. During infancy and childhood, attachment figures provide a sense of safety and security that allows children to explore and interact with the world around them. When children lack these close figures, they may struggle to form meaningful relationships with others and may experience emotional isolation and loneliness (De Jong Gierveld et al., 2006; Mikulincer & Shaver, 2013, 2021; Weiss, 1987). Additionally, individuals who experience loss or separation from attachment figures later in life may also struggle with feelings of loneliness and emotional isolation. For example, older adults who lose a spouse or partner may experience profound loneliness and social isolation, which can have negative effects on their physical and mental health (De Jong Gierveld et al., 2006; Mikulincer & Shaver, 2013, 2021; Weiss, 1987). Overall, attachment figures play a critical role in social development, and the absence of these figures can lead to social difficulties and negative outcomes such as loneliness and emotional isolation.

Attachment Networks and Mental Health

Attachment networks refer to an individual's closest relationships that function as emotional support, and the individual can seek proximity, protection, and support from these intimate figures (e.g., family members, romantic partners, and best friends) (Bowlby, 1982; Cassidy, 1999; Cassidy & Shaver, 2008; Dougherty & Feeney, 2004).

Children begin to expand their attachment networks with age, and more close figures are added in the network besides parents (e.g., peers/best friends and romantic partners) (Ainsworth,

1991; Allen & Land, 1999; Bowlby, 1969; Fraley & Davis, 1997; Furman, 1999; Hazan & Ziefman, 1994; Scharf & Mayseless, 2007; Shulman & Collins, 1997; Weiss, 1993). These close figures are essential to forming multiple attachment relationships. As attachment functions develop, an individual's primary attachment figure is transferred from parents or related caregivers to peers or close friends. As adolescents become mature (early adulthood), romantic partners are more likely to be considered as their primary attachment figure (Bowlby, 1969, 1982; Mikulincer & Shaver, 2007). As adolescents transfer to early adulthood, their parents may be less readily accessible or obtainable, and the trend of the attachment network inclines to be more complicated and diverse as the attachment functions shift step by step (Ainsworth, 1991; Bowlby, 1969; Hazan & Zeifman, 2008; Kobak, Rosenthal, & Serwic, 2005; Kobak, Rosenthal, Zajac, & Madsen, 2007). The transfer of the figures in attachment networks during adolescence is considered as normative change and lays a foundation for adulthood. Some research has explored the change of preference for the close network figures from late adolescence to early adulthood (Fraley & Davis, 1997). The results have demonstrated that parents, for most of the time, are the primary attachment figures in the attachment hierarchy, but the preference for peers or romantic partners have an increasing tendency, especially for emotional support (Fraley & Davis, 1997; Weiss, 1994).

In young adulthood, romantic partners and best friends play functions as a safe haven and a secure base in attachment networks with the formation of romantic relationships and the development of close friendships (Fraley & Davis, 1997; Trinke & Bartholomew, 1997). The composition of the attachment networks during middle adulthood may change slightly. Children become more important as parent-child relationships are developed, but spouses and best friends still play indispensable roles in attachment networks (Antonucci et al., 2004). Those of people

who are childless may tend to have more active sibling ties (Antonucci et al., 2004; Connidis & Campbell, 1995). Nevertheless, from middle to late adulthood, the composition in attachment relationships remains stable, but the attachment networks may become smaller (Antonucci et al., 2004). Cicirelli (2010)'s study has investigated attachment relationships for younger and elder adults. The findings have indicated that older people have smaller attachment networks and less attachment figures than younger adults, and spouses are always on the top of the attachment hierarchy. Attachment figures are integral to maximum adaptation for elders, which also influences mental health (Cicirelli, 2010).

The study of attachment networks has been integrated into the study of close relationships by researchers in order to gain a more complete understanding of the impact of close relationships on mental health. In the previous research, more attention was paid to infant and child attachment. Nevertheless, more research has expanded to adolescent or adult attachment in order to examine multiple relationships within a network system (Hendrick & Hendrick, 1994; Scarf, 2017). People desire to connect, develop, and maintain secure interpersonal attachments (Bowlby, 1969; Jordan, 2010). The attachment in romantic relationships during adulthood was investigated and tackled by Hazan and Shaver 's (1987) seminal study, which enlarged the scope of attachment. Based on the research, Hazan and Shaver proposed a measure of attachment styles based on adult romantic relationships (Hazan & Shaver, 1987). They suggested that everyone has their own internal working models of attachment, which are developed in early childhood based on their interactions with primary caregivers (Hazan & Shaver, 1987). Three primary attachment styles have been identified, including secure, anxious, and avoidant, which are thought to shape the way that people perceive and experience intimate relationships throughout their lives (Hazan & Shaver, 1987).

The Measures of Attachment Networks

Hazan and Shaver (1994)'s seminal work in developing a measure of attachment networks indicate that attachment behaviors and cognitions are used to identify who is considered to be an attachment figure. These included 1) proximity maintenance, 2) safe haven, and 3) secure base. These features are essential for understanding attachment networks. The function of proximity maintenance indicates the behavior that individuals desire to seek and remain the closeness to attachment figures. People will feel distressed if they separate from their attachment figures. The function of safe haven describes that people are attached to their preferred figures for support, comfort, or safety when they feel threatened, distressed, or vulnerable. The third function is secure base which demonstrates that people can take risks to explore the world from the safety and support that are provided by their attachment figures (Bowlby, 1988; Hazan & Shaver, 1994; Waters & Cummings, 2000). One's network of attachment figures will be established if two or more figures fit these characteristics, although these figures are not necessarily considered equal sources of attachment support. It should be noticed that every attachment figure in a network does not have to be the equal targets for attachment behaviors.

The WHOTO (Hazan et al., 1991; Hazan & Shaver, 1994) is the first scale used to determine the composition of attachment networks beyond childhood. The scale was initially developed by Hazan et al., (1991, 1994) as a single forced choice scale, but it was not able to examine the level of primary attachment figures in terms of the three attachment features (i.e., proximity maintenance, safe haven, and secure base). Fraley and Davis (1997) later modified the WHOTO for Likert scaling. The modified version of the scale allowed participants to write the name(s) of the people who best served each of the attachment features. Two composite scores

(ranging from 1-4) were set for each of the attachment features to indicate the extent to which participants used a specific person (i.e., romantic partners and best friends) as an attachment figure (Fraley & Davis, 1997). The scale contains six questions referring to the three characteristics of attachment behaviors and cognitions (proximity maintenance, safe haven, secure base) that differentiate attachment figures from non-attachment figures (Hazen et al., 1991, 1994). The question, "Who is the person you can always count on to be there for you no matter what happens?" is a part of six-item ranking scale in the WHOTO (Hazen et al., 1991, 1994). Based on the scale, the individual's primary attachment figures can be identified, but the rest of the attachment hierarchies are not clear.

In comparison with the WHOTO, the Attachment Networks Questionnaire (ANQ) (Trinke & Bartholomew, 1997), an eight-item ranking scale, is used to measure multiple attachment figures in adult attachment network and examine the characteristics of attachment hierarchies (ANQ, Trinke & Bartholomew, 1997). Based on the three attachment features, participants can list as many people as they think are important to them (Trinke & Bartholomew, 1997). For example, a safe haven item from the ANQ (Trinke & Bartholomew, 1997) shows, "Whom do you actually go to, to help you feel better when something bad happens to you or you feel upset?" Similarly, the Important People Interview (IPI) (Rosenthal & Kobak, 2010), a nine-item ranking survey, is applied to examine adolescents' attachment hierarchies and differentiate their attachment figures from other supportive individuals (Rosenthal & Kobak, 2010). For instance, the question, "Who would you most choose to be with if you wanted to have fun and have a good time?" is the item of proximity maintenance from IPI (Rosenthal & Kobak, 2010). The total or average scores of these scales are calculated, and the person who gets the highest

score is considered as the primary attachment figure after comparing with other network members (Rosenthal & Kobak, 2010; Trinke & Bartholomew, 1997).

According to these traditional measures, Fraley and Davis (1997) investigated the transfer of attachment-related functions from parents to close friendships and romantic relationships in young adulthood. The transference of the attachment functions from parents to peers as primary attachment figures was increased (Fraley & Davis, 1997). Moreover, the essential factors such as caregiving, trust, and intimate contact were indispensable for facilitating the development of attachment formation in early childhood, which was also positively associated with the development of attachment in adult relationships (Fraley & Davis, 1997). Trinke and Bartholomew (1997)'s study examined adult attachment hierarchies. On average, 5.38 attachment figures were included in adult attachment networks. Peers had a higher-ranking score for safe haven functions than secure base functions, and romantic partners were ranked more highly than any other attachment figures (i.e., parents, siblings, and best friends) as a safe haven (desired and actual use) and a secure base (desired use) (Trinke & Bartholomew, 1997). Similarly, Rosenthal and Kobak (2010) tested adolescents' attachment hierarchies, and romantic partners were ranked in higher positions. However, the traditional approaches have only used six- to nine-item ranking scales to analyze each of the three attachment features. Although the ranking scales are fit for the identification of the composition in attachment networks and the primary attachment figures, the ordinal and the forced choice scales are not able to indicate an accurate measurement of attachment strength and within-subject comparisons between network figures (Freeman & Simons, 2018; Freeman et al., 2021). More study is needed to examine the significance of subsidiary figures (relationships) in the attachment network structure.

The Bull's Eye, a new diagrammatic measure, has the potential to address the gap that is discussed above (Rowe & Carnelley, 2005). The Bull's Eye is on the basis of the Hierarchical Mapping Technique (HMT) (Antonucci, 1986), which is developed to study an individual's entire social network. Rowe and Carnelley (2005) modified and improved the HMT to concentrate on attachment relationships and also renamed the Bull's Eye diagrammatic technique. This new diagrammatic measure is significantly different from ranking scale, which allows for independent and continuous rating of network figures on ratio scale, but not ordinal scale (Rowe & Carnelley, 2005; Scharfe, 2020). Using the Bull's Eye, researchers are able to evaluate new indicators of attachment network structures, such as attachment strength and morphology (Freeman & Simons, 2018; Freeman et al., 2021). To complete the diagrammatic measure, participants need to put the paper dots onto a target with three concentric circles, and these paper dots represent the people that have the most important relationships with participants. The center of the target is marked as "core self," and participants are required to place each of the people a distance from their core self "in a way that is important to you" (Rowe & Carnelley, 2005, p. 503). Later, the Bull's Eye was replaced by a computer version (Freeman et al., 2021). The procedure is similar to the paper version, but drag and drop technology is used for the Bull's Eye diagram. A list of figures (i.e., mother, father, best friend, boy or girlfriend, and others) are given on the right of the diagram (Freeman et al., 2021). However, the Bull's Eye is cumbersome to manually deliver and score and has some problems in validity. Moreover, this diagrammatic measure cannot effectively distinguish young adult attachment cognitions and behaviors (safe haven, secure base, and proximity maintenance) from other behavioral systems such as identity exploration and companionship (Freeman et al., 2021).

Based on the limitation of the Bull's Eye, the Web-based Hierarchical Mapping Technique (WHMT) was developed and tested by Freeman's team (2018, 2021). This is a hierarchical mapping diagram of concentric circles with expanded analytic capability. The WHMT is a diagrammatic online measure that first asks participants to self-select 5 important people (from a dropdown menu) in their social support network. After selecting support figures, participants are shown a target diagram with three concentric circles. Participants are instructed to drag and drop five icons representing each of the self-selected support figures into the target area diagram so that the distance to the center represents how emotionally close they are to that support figure. Pixel distance between the center and each person is recorded. Next, participants complete a second version of the WHMT in which they place each figure a certain distance from the center that represents how close they live from the participant (Freeman et al., 2021). The WHMT can examine metrics beyond composition such as strength, morphology, physical closeness, and social network analysis metrics (i.e., density and centrality). For morphology, attachment hierarchical and nonhierarchical structure can be visually displayed. Moreover, differences between variations of morphology of the attachment network structure also can be identified (Freeman & Simons, 2018; Freeman et al., 2021).

Attachment Network Structures Based on the WHMT

Before the advent of the WHMT, no appropriate assessment has previously been found to explore the multidimensional structures in social networks with the availability to effectively connect the four metrics to adult mental health (composition, strength, morphology, and physical proximity) (Freeman & Simons, 2018; Freeman et al., 2021). In this study, the WHMT will be applied to address the gaps in the attachment literatures measuring adult attachment networks. It

also examines how the four facets of an attachment network inform adult mental health outcomes, especially in anxiety, depression, and suicidal ideation.

Composition of the Network

The first metric examined in this study is the composition of the attachment network. A great number of the existing studies on attachment networks only concentrate on composition, with a stress on the primary figures in the hierarchy (Dougherty & Feeney, 2004; Fraley & Davis, 1997; Freeman & Simons, 2018; Hazan et al., 1991; Hazan & Shaver, 1994). Freeman and Simons (2018) suggest that researchers in attachment studies ignore the differences or complexities among the diverse types of structures in the attachment network when defining and examining only one metric (composition). The research on attachment networks has started to examine multiple dimensions and individual differences broadening attachment network study (Freeman & Simons, 2018; Mayseless, 2004; Pitman & Scharfe, 2010).

Most of the studies on attachment figures and mental health outcomes have concentrated on adolescent attachment networks since adolescence is a vital developmental stage and one of the most notable and prominent phases in all life transitions (Ainsworth, 1985; Gentina et al., 2016). Some research has suggested the connection or interaction of one's certain support figures, or lack of intimate relationships may be related with some mental health problems including anxiety, depression, and suicidal ideation (Bryant, 2016; Christakis & Fowler, 2007; Leavy, 1983). If adolescents are not able to sustain close relationships and do not have a specific primary attachment figure (e.g., mothers or fathers), there will be an increased risk of social failure (Freeman & Simons, 2018). Furthermore, when parents are not accessible and friends or romantic partners are not primary attachment figures, adolescents may have a feeling of isolation, distress, and anxiety (Bowlby, 1969, 1982; Steinberg, 2001).

Strength of the Network

The second metric explored in this study is the strength in the attachment network structure. Network strength is one of key factors but overlooked by the literature of attachment networks (Freeman & Simons, 2018; Freeman et al., 2021; Laible, Carol & Roesch, 2004). Strength of the network concentrates on a measure of the degree of closeness, which indicates how attachment figures in each relationship is close to an individual (Freeman & Simons, 2018). Strength is distinct from composition. Strength is embodied in the number of close network members, but composition can find expression in primary or top close figures in the network. Moreover, relative strength between network members can be also applied to understand the shape or variation of the network (morphology).

Cassidy (1994, 1999) connected the terminology "social penetration" to the strength of close relationships, which described how the process of penetration was associated with strength of network. The theory of social penetration refers to the process of relationship development from superficial communication to close communication between individuals (Altman & Taylor, 1973). The scope of close relationships (breadth) and the level of intimacy (depth) are the crucial factors that affect the penetration (Altman & Taylor, 1973). Attachment can integrate into multiple areas of life. The extent of penetration of attachment figures influences the metric of strength in the attachment network (the greater the penetration of attachment figures, the higher level of the strength metric in the attachment network) (Cassidy, 1999). However, people may have secondary attachment figures (further emotional distance) but with deeper penetration in their emotional life (from closer physical distance) compared with other people's primary attachment relationships (e.g., closer emotional distance but further physical distance). Based on this situation, the strength of secondary attachment figures may be stronger than primary figures.

Therefore, network strength is not always matched with ranking measures of attachment networks (the primary figure, the secondary figure, or the tertiary figure). The attachment figures that are placed on the top of the hierarchy does not always mean that they have stronger strength than other close figures in the network. All network members are independently rated on strength.

If people have closer attachment relationships in various areas of life, their strength for attachment figures will be greater. The concept of social penetration can be used to measure strength of an attachment network through identifying the number of close figures in one's support network that permeate into the individual's life. There is scant research on the metric of strength in the literature of attachment networks (Freeman et al., 2018; Rowe & Carnelley, 2005). Although Rowe and Carnelley (2005) discussed and investigated the strength of networks for the first time, they did not emphasize too much on the strength of attachment figures.

The lack of network strength between individuals and their attachment figures may cause emotional distress, anxiety, and social isolation (French & Conrad, 2001, Mikulincer & Shaver, 2007). Nevertheless, if adolescents have experience with intimate attachment support, they will be inclined to display healthy interactions with others and demonstrate empathy, emotional connection, and awareness (Laible, 2007; Laible et al., 2004). However, few literatures have investigated and examined the association between adult attachment networks and the outcomes of mental health (Laible et al., 2000; Millings et al., 2012). Based on the implications of adolescent attachment networks with mental health, this study will focus on adult attachment networks and further explore how adult network strength is connected with mental health.

Morphology of the Network

The next metric investigated in the present study is morphology, that is, the shape of the network structure. Morphology of the network structure is closely correlated with the relative strength of a network through five closest network members (the degree to which network members are hierarchically or nonhierarchically organized) (Freeman & Simons, 2018). Morphology concentrates on four types of structural patterns. One of the patterns is nonhierarchical (without a clear hierarchy), and the rest of three are hierarchical. The hierarchical patterns consist of three types of network structures, including monotropic, joint principal, and diversified, but the nonhierarchical pattern only includes distributed network structure (Freeman & Simons, 2018). Monotropic structure in the network describes that one has a clear order of preference in the network structure and only concentrates on a single primary attachment figure (Bowlby, 1969, 1982; Cassidy, 2008; Freeman & Simons, 2018). Joint principal structure in the network indicates that an individual has two primary attachment figures and no differentiation between the figures (Freeman & Simons, 2018). Diversified structure is the last hierarchical pattern, which delineates that a person has a clear order or a differentiation of attachment figures between the primary and the secondary member and between the secondary and the tertiary figure in the network (Cassidy, 2008; Freeman & Simons, 2018). Lastly, the network with a distributed structure displays a nonhierarchical formation, which means the attachment members in the network lack differentiation (Freeman & Simons, 2018). In comparison with hierarchical structures, the distributed network does not have a clear order of attachment preference between the three closest relationships (Freeman & Simons, 2018).

Freeman and Simons' (2018) study is the only attachment literature so far that has discussed the assessment of morphology with four variations of structure patterns. Freeman and

Simons have introduced the close connection between attachment figures and the whole patterns finding significance in the multiple forms of the network structures. The research has also provided evidence to support the hypothesis that a nonhierarchical structure in adults' attachment networks may demonstrate an increased number of mental health issues (Freeman & Simons, 2018).

In addition, in the study of morphology in adolescent network structures, hierarchical patterns and nonhierarchical structure have predicted different results of mental health symptoms, such as depression, anxiety, and suicidal ideation (Freeman & Simons, 2018). For instance, when one has shown difficulty establishing close relationships with others, the findings on nonhierarchical network structure has demonstrated the lack of adaptation and struggling to build and maintain close relationships (Freeman & Simons, 2018).

However, there is insufficient evidence to support the links between multiple attachment structures and the outcomes of adult mental health. Although Freeman and Simons' (2018) research provides precise and efficient data and analysis for describing three hierarchical models and one nonhierarchical structure, additional studies are still needed to understand the different structure patterns and connections to the outcomes of adult mental health (Cole et al., 2002; Doherty & Feeney, 2004; Freeman & Brown, 2001; Freeman & Simons, 2018; Friedlmeier & Granqvist, 2006). This study will fill in the gap.

Physical Proximity of the Network

The final metric discussed in the study is physical proximity, which is focused on the physical distance and geographical location of every network member in relation to each other. The key point in physical proximity is "distance," which is important to children and their caregivers and may affect the caregiving experience (Bei et al., 2022; Bowlby, 1969, 1982).

Physical proximity is crucial in attachment theory and to close relationships. Bowlby (1969, 1982) and Ainsworth's (1989, 1991) research has demonstrated that infants feel anxious and distressed when they are far away or separated from their primary caregivers, which causes insecure attachment. For children or adults, physical closeness to attachment figures in the networks provides a safe haven and a sense of safety (Bei et al., 2022; Ben-Ari, 2012; Kiesler & Cummings, 2002). Most studies on physical proximity have concentrated on the links between attachment styles in physical proximity and mental health outcomes (Shrivastava & Burianova, 2014; Takano & Mogi, 2019). However, only a little research has discussed physical distance in adult attachment regarding mental health outcomes (Feeney, 1998; Garrett et al., 2019). The present study will concentrate on physical proximity of networks in adult close relationships and further examine how it links to the issues of mental health.

Present Study

This current study addressed the gaps in the literatures of attachment and close relationships in respect of how an attachment network informs the outcomes of mental health by using the WHMT. The WHMT provides more comprehensive analysis for attachment network figures compared with existing attachment studies. The whole process of the assessment is computer administered, scored, and analyzed. The four metrics of the network (composition, strength, morphology, physical proximity) were examined to explore the complex and multifaceted relationships between adult network figures. Specifically, emotional and physical distance between network members, and the form of their attachment networks were also included to explain mental health outcomes, including anxiety, depression, and suicidal ideation. There is some limited support in the attachment literature that suggests an association between the organization of attachment network figures and mental health results. Furthermore,

relationships with some preferred attachment figures may also explain the connection of the network metrics with mental health outcomes (Freeman & Simons, 2018; Hazan & Zeifman, 1994). However, there has been little research to indicate some empirical evidence of these results.

Attachment Quality as a Moderating Variable and Other Potential Moderating Effects

A great number of attachment studies are focused on attachment style or quality as the predictor of mental health in close relationships (Bartholomew & Horowitz, 1991; Freeman & Almond, 2010; Freeman & Simons, 2018). Nevertheless, this study does not concentrate on attachment quality or style as the primary predictor, but rather use the quality of attachment as a moderating variable. The present study examines attachment quality as a moderator of the link between adult attachment network structures and mental health. Furthermore, the current study also look at other potential moderating effects, such as age, gender, and romantic relationship status.

According to the rationale of developmental age category, Medley's (1980) study has suggested the age demarcations based on four stages of adult life, including early adulthood (ages 22-34), early middle age (ages 35-44), late middle age (ages 45-64), and late adulthood (ages 65 and older). Medley (1980) examined life satisfaction across the four stages of adult life. These different age categories demonstrate that individuals go through the different stages of physical, cognitive, emotional, and social development, and these stages have distinct characteristics.

In early adulthood, this stage is characterized as a time of affirmation (Medley, 1980). Individuals seek affirmation of their status as mature (full-fledged) adults and assert the independence of their nuclear family (Medley, 1980). People in the age range of twenty-two to

thirty-four are likely to experience anxiety with financial stress. During the stage of early middle age, this age group is characterized as the notion of attainment. The common trend observed among individuals aged from thirty-five to forty-four is the emphasis on achievement, particularly in relation to their socioeconomic status (Medley, 1980). Early middle age is often regarded as the stage characterized as a time of considerable stress because of work and family. However, individuals between the ages of forty-five and sixty-four (late middle age) are likely to experience a realization of diminishing physical abilities and a decline in their overall health status, but with less mental health issues because of relatively stable work and family situations (Medley, 1980). In late adulthood, people who are sixty-five or older are prone to experiencing a sense of liberation or accession. Most people during this stage are retired and experience changes in the parent-child relationships. Late adulthood appears to be a period characterized by significant life satisfaction (Medley, 1980).

Normative trajectories in anxiety, depression, and suicidal ideation across adulthood are similar. Anxiety tends to decrease with age, and the relative studies have reported that symptoms of anxiety usually peak during early adulthood and gradually decline as individuals grow older (Kessler et al., 2005). Nevertheless, the trajectory of depression is more complex and can vary among individuals. While depression can occur at any age, it tends to be more prevalent during adolescence and early adulthood. In midlife, there is often a decrease in depressive symptoms (Kessler et al., 2005). Additionally, suicidal ideation can be influenced by various factors across adulthood. Young adulthood is a period where suicidal ideation may be more prevalent due to significant life transitions or high stress levels. As individuals move into midlife and older adulthood, suicidal ideation tends to decrease (Kessler et al., 2005).

In addition, some empirical support in the pertinent literature has indicated that gender has a moderating effect on adolescent mental health (Carver et al., 2003; Davies & Windle, 2000; Freeman, 2017). Moreover, gender is also an essential and salient factor regarding mental health outcomes; in fact, there is a significant difference in anxiety and depression between females and males (Mojtabai et al., 2016; Twenge et al., 2015). It is also noteworthy that whether different age groups (e.g., young adults vs old adults) moderate the relation between the network structures and the outcomes of mental health.

Summary

Close relationships and attachment literatures encompassing network structure and mental health issues indicates that it is reasonable to assume that attachment network structures and related patterns are associated with adult internalizing problems, such as anxiety, distress, depression, and suicidal ideation. Up to now, little research has been focused on how the four metrics in this study affect adult attachment networks and illuminate mental health problems. Differences and variations in the structures and patterns of network structures are displayed in the pertinent literature and illustrate a connection to mental health issues. It is important to comprehend the primary, secondary, tertiary network members in adult attachment networks, which may provide a basic understanding and lay a foundation for how the network structures are formed. Based on limited or incomplete studies on adult close relationships and attachment network patterns, it is crucial and significant to explore and examine the associations between attachment networks and outcomes of adult mental health (Freeman & Simons, 2018; Freeman et al., 2021).

Research Questions and Hypotheses

Composition-

H1: Young adults between 24 to 35 years of age will identify parents as primary attachment figures more often than older adults.

H2: Adults greater than 65 years of age will identify children as attachment figures more than adults younger than 65.

Q1: Do different attachment figures across different age groups positively explain differentiations/differences in mental health?

Strength-

Q2: Does attachment strength for different age groups or sex categories explain differences in adult mental health outcomes, including anxiety, depression, and suicidal ideation?

Morphology-

Q3: Does network morphology (monotropic, joint principal, diversified, or distributed network structure pattern) for different age groups or sex categories explain differences in the outcomes of adult mental health, including anxiety, depression, and suicidal ideation?

Physical Proximity/Distance-

Q4: Does physical distance (proximity) for different age groups or sex categories explain differences in adult mental health symptoms, specifically in anxiety, depression, and suicidal ideation?

Chapter Three: Methods

Overview

This chapter presents a description of the sample, procedures, methods, the detailed information of the research participants (sample), processes, related measures, data collection, and plan of analysis.

Participants

The participants in this study were recruited online by using a convenience sampling method. Two online surveys were used (i.e., the WHMT and a Qualtrics survey), and it was finally posted to the Cloud Research platform. Participating in the study was voluntary. All the identifying information (i.e., Amazon Mechanical Turk-MTurk Worker ID) that the participants provided was stored separately from their survey responses, and their names or any other identifying information were confidential and not associated with the study results. Anonymity was important and indispensable in order to protect participants' identity at Institutional Review Board (IRB) standards. The sample included 1021 adults (583 females) aged from 24 to 80 (M = 42.9), who completed the Web-Based Hierarchical Mapping Technique, a diagrammatic measure of attachment network composition, strength, morphology, and physical proximity (WHMT, Freeman et al., 2021; Freeman & Simon, 2018). From the cross-sectional study, the participants represented a diverse group of individuals (e.g., race, economy, educational level). There were 49 % participants living in suburban areas with their romantic partners or spouses. The respondents also reported their romantic relationship status and the duration of current relationship to their partners. The number of respondents currently are married (N = 454, 44.5%) compared to those who were not romantically involved with someone or dating (N = 283, 27.7%). The length of time in a current relationship ranged from "less than one month" (0.2%) to

"eight years or more" (43.7%). There was missing data for some of the questions, but most of them were considered valid. The participants completed the online survey in their own place with more than 90% completion rate. I tested the attachment networks in context and the WHMT data collection multiple times before launching it for data collection online.

Power Analysis (Multivariate Analysis of Variance (MANOVA) and Multiple Regression)

I conducted two statistical power analyses, which included MANOVA and multiple regression (Faul et al., 2007). G*Power was launched, and "MANOVA: Special effects and interactions" option under the "A priori: F Tests" category was selected. The effect size of 0.15 was used as a value to measure the strength of the relationship between two groups. The level of significance ($\alpha = 0.05$) and the desired power ($1-\beta = 0.80$) were set respectively. The results of the power analysis indicated that a minimum sample size of 52 participants for this research would be necessary to detect the desired effect with 80% power while controlling the probability of a Type II error at 5%. These results suggest that the proposed sample size is sufficient to detect meaningful effects (Faul et al., 2007).

Based on the power analysis of multiple linear regression ("multiple regression: fixed model" option under the "a priori: linear regression), The effect size (Cohen's f^2) of 0.15 was set. The alpha level of 0.05 was also used as the level of significance, and the statistical power was not changed which was set at $1-\beta = 0.80$. The results of the power analysis suggested that a minimum sample size of 99 participants for this study would be necessary to detect the desired effect with 80% power while controlling the probability of a Type II error at 5%. These results also demonstrate that the proposed sample size is sufficient to detect meaningful effects (Faul et al., 2007).

Procedure

All the data responses (The WHMT and attachment networks in context) were collected electronically. After I got approval from the Institutional Review Board (IRB) of the University of South Dakota, I used the crowdsourcing platform Amazon's Mechanical Turk (MTurk) in conjunction with Cloud Research MTurk Toolkit to recruit and conduct all contact with the participants. The selection criteria of the study population included all adults (i.e., males, females, university students, employees, and others) aged from 24-80 with diverse ethnic groups (i.e., American Indian, African American, Caucasian, Asian, and others). Another inclusionary criterion included the participants who were currently living in the same residence in which they have lived during most of the COVID-19 Pandemic. Once screened and consented, the participants enrolled in the study through an online consent form, followed by the WHMT (5 minutes), and a 25-minute Qualtrics survey. I asked the participants to enter their worker ID for each survey (i.e., WHMT and Qualtrics survey).

The research team also explained the benefits, possible risks, and compensation to the participants of the study in the informed consent form. Other contact information for the study was provided as well. In order to incentivize completion of the two online measures, the participants were compensated $2.50 for completing the survey. There were also attention checks throughout the survey, such as (1) I have been to every country in the world, (2) I sleep less than one hour per night, and (3) I do not understand a word of English. If the participants did not pass 3 of the 4 attention checks, they would not be eligible for the compensation.

Data Collection

Five researchers (four student investigators and one principal investigator) participated in the data collection process by creating the online survey of attachment networks and using the

WHMT assessment that was modified by the principal investigator of the study. The WHMT assessment is a newly validated measure of attachment network structure that utilizes ratio scaling to assess four separate metrics of attachment networks, including composition, strength, morphology, and physical proximity. The participants completed a modified version of the WHMT that measures the respondents' physical distance and relative geographic location to each of their five closest network members (Freeman et al., 2021). After completing the WHMT, the participants completed a Qualtrics survey that included extensive questions on participant demographics, mental health scales, and attachment relationships. The survey included questions about the respondents' emotional connection to the people closest to them and to their place of residence. Furthermore, I also asked sensitive questions about the participants' mental health on experiences with anxiety, depression, and thoughts of suicide. To link the surveys, participants entered their MTurk ID at the beginning of each survey. The data that were used for analysis were part of a larger study examining the normative structure of adult attachment networks.

Measures

This study applied the newly adapted web-based assessment to collect data with a large adult population that investigated the four metrics: network composition, strength, morphology, and physical proximity and the correlation with the four facets regarding the outcomes of adult mental health. The survey included thirteen different scales of measurement on four, five, and seven-point Likert scales. The crucial scales that were used in this study included the assessment tool of the WHMT (Freeman et al., 2021), Experiences of Close Relationships-Revised-General Short Form (ECR-R-GSF, Wilkinson, 2011), the Patient Health Questionnaire (PHQ-9, Kroenke et al., 2002), Generalized Anxiety Disorder (GAD-7, Spitzer et al., 2006), and the Suicide Behaviors Questionnaire-Revised (SBQ-R, Osman et al., 1999).

Demographics

The following demographic information was assessed, which included respondents' age, gender/sex, ethnicity, socioeconomic status (SES), and romantic relationship status. People who were considered as participants' closest attachment figures (primary attachment) were reported as well.

The participants reported their romantic relationship status. The descriptions of relationship status included six options: (1) Not currently romantically involved with someone or dating, (2) Dating one person but we are not seriously involved, (3) Dating one person and we are seriously involved, but we are not living together, (4) Living with my partner, but we are not married, (5) Engaged to be married, (6) Married. Moreover, the respondents were also asked to report on the duration of the current relationship to their partner, and the options were included from "less than one month" to "eight years or more".

The Web-Based Hierarchical Mapping Technique (The WHMT)

The WHMT assessment is a newly developed and computer-based measure of attachment network structure that uses ratio scaling to examine the structure of attachment social networks (WHMT, Freeman et al., 2021). Primary and other attachment figures were recognized to address composition, strength, morphology, and physical proximity. Composition in attachment network structures was measured by the primary attachment figure(s). Attachment strength was examined by two variables, which included the number of attachment figures and the average emotional distance score for the three highest rated attachment figures or all five close figures (centrality). Four variations for morphology were determined by the shape of the attachment network structure. Physical proximity (distance) was measured by calculating the pixels to describe physical distance and geographical location of every network member in relation to

each other (Freeman et al., 2021; Freeman & Simon, 2018). The WHMT is concentrated on the measurement of the distance to the center of the network and between each one of the attachment members in one's attachment network. Furthermore, the WHMT assessment also provides a method to measure the number of attachment figures in the center of the concentric circle. The participants need to choose five closest people they feel have the most impact on their life from a list of relationship categories (i.e., "mother", "father", "romantic partner", "best friend(s)", and so on) or may enter other figures narrative in their current life into the circle to show how close the members are to "yourself".

The recent study on attachment networks demonstrated the WHMT with strong test-retest validity and reliability (Freeman et al., 2018, 2021; Harper, 2020). Moreover, the Hierarchical Mapping Technique (HMT) was validated by Rowe and Carnelley (2005) since the WHMT was adapted from the HMT. The WHMT also displayed construct validity when Freeman et al., (2018) tested with a young adult population.

Experiences of Close Relationships-Revised-General Short Form (ECR-R-GSF)

The Experiences of Close Relationships Questionnaire Survey (ECR-R-GSF, Wilkinson, 2011) is a twenty-item self-report survey and widely applied to measure attachment experiences in all relationships (i.e., family members, friends, romantic partners, and others). ECR-R-GSF was designed and modified based on the scale of Experiences of Close Relationships-Revised (ECR-R) (Fraley et al., 2000; Wilkinson, 2011). Eleven out of the twenty items in ECR-R-GSF were finally applied in this study. The questions of the questionnaire are linked to the respondents' closest relationships. The respondents need to respond to each statement by indicating how much they agree or disagree. Each item of the scale is on the basis of 7-point Likert from 7 (strongly disagree) to 1 (strongly agree).

The internal consistency reliability of the general ECR-R scale (Cronbach's α) tended to be 0.9 or higher, which was regarded as an excellent level (Fraley et al., 2000). The internal consistency reliability of this scale indicated Cronbach's alpha at over 0.80, which was considered as a very good level (Sibley & Liu, 2004). The inter-rater reliability (intraclass correlation coefficient, 0.82; 95% CI, 0.80-0.83) was high (Fraley et al., 2000; Wilkinson, 2011).

The Patient Health Questionnaire (PHQ-9)

The Patient Health Questionnaire (PHQ-9, Kroenke et al., 2002) is a nine-item self-report depression scale. PHQ-9 is used to measure people's frequency of suicidal ideation and the severity of depressive disorders or symptoms (Kroenke et al., 2002). The response format of the scale ranges from 0 (not at all) to 3 (nearly every day). Each item of the scale is based on the question "Over the last two weeks, how often have you been bothered by any of the following situations or problems?" The items briefly describe different situations or problems, such as (1) little interest or pleasure in doing things, (2) feeling down, depressed, or hopeless, and (3) trouble falling or staying asleep, or sleep too much. Additionally, the level of seriousness of depression is measured at the end of the PHQ-9 scale. The assessment is related to the question "If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?" The options of the assessment include (1) "not difficult at all", (2) "somewhat difficult", (3) "very difficult", or (4) "extremely difficult".

According to the validity and reliability of the Patient Health Questionnaire (PHQ-9, Kroenke et al., 2002), internal consistency reliability: Cronbach's alpha was found to be 0.88, which was considered a very satisfactory level. Most studies reported the inter-rater reliability

(intraclass correlation coefficient, 0.89; 95% CI, 0.86-0.95) was high. The PHQ-9 indicated a sensitivity of 88% and a specificity of 88% for major depressive disorders (Kroenke et al., 2002).

Generalized Anxiety Disorder (GAD-7)

Generalized Anxiety Disorder (GAD-7, Spitzer et al., 2006) is a seven-item self-report anxiety scale. GAD-7 has high reliability and validity support and is developed to examine individuals' severity of anxiety symptoms (Löwe et al., 2008; Spitzer et al., 2006). The response format of the scale ranges from 0 (not at all) to 3 (nearly every day). Each item of the assessment is also on the basis of the question: "Over the last two weeks, how often have you been bothered by any of the following situations or problems?" The items also simply delineate different situations or problems, such as (1) feeling nervous, anxious, or on edge, (2) not being able to stop or control worrying, and (3) worrying too much about different things. Furthermore, the level of seriousness of anxiety is measured at the end of the GAD-7 scale. The measurement is also relevant to the question: "If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?" The options of the assessment include (1) "not difficult at all", (2) "somewhat difficult", (3) "very difficult", or (4) "extremely difficult".

Based on the validity and reliability of Generalized Anxiety Disorder Scale (GAD-7, Spitzer et al., 2006), internal consistency reliability: Cronbach's alpha was at 0.92, which was considered an excellent level. The inter-rater reliability (intraclass correlation coefficient, 0.92; 95% CI, 0.91-0.93) was high. The results from previous studies indicated sensitivity and specificity ranged from 0.72 to 0.89 and 0.83 to 0.91 separately (Kroenke et al., 2002).

The Suicide Behaviors Questionnaire-Revised (SBQ-R)

The Suicide Behaviors Questionnaire-Revised (SBQ-R, Osman et al., 1999) is a four-item psychological self-report questionnaire survey. SBQ-R has strong reliability and validity support and is designed to examine and recognize people's risk factors and behaviors for suicidal ideation (SBQ-R, Osman et al., 1999). The survey included the four questions with a different dimension of suicidality (i.e., lifetime suicide ideation and/or suicide attempt, the frequency of suicidal ideation over the past year, the threat of suicide attempt, and self-reported likelihood of suicidal behavior someday in the future). The item response format of the survey ranges from 0 (never or not at all) to 4-6 (very often or likely), and the respondents are required to check one option only.

On the basis of the validity and reliability of the Suicide Behaviors Questionnaire-Revised (SBQ-R, Osman et al., 1999), internal consistency reliability: Cronbach's alpha was over 0.80, which was considered a very good level. The inter-rater reliability (intraclass correlation coefficient, 0.82; 95% CI, 0.80-0.84) was high. The SBQ-R survey had a sensitivity of 93% and a specificity of 95% for major anxious symptoms (adult general population) (SBQ-R, Osman et al., 1999).

Plan Analysis Procedures

Statistical Package for the Social Sciences (SPSS, version 28) was applied for the data analysis after the investigation of the study was completed. The data collected from the two online measures was screened, and the data cleaning was completed for the statistical analysis. In the next step, missing data was filtered and cleaned as well. Multivariate Analysis of Covariance (MANCOVA) and Hierarchical Multiple Regression procedures (HMR) were utilized and conducted to analyze the cross-sectional data.

Descriptives and Assumption Checks

The demographics that were summarized in this study included age, sex, and romantic relationship status. I used descriptive statistics to summarize the distribution of each demographic characteristic, such as mean, median, mode, and standard deviation. Frequency distributions were also applied to determine the number and percentage of individuals in each category for each demographic characteristic. Moreover, I also provided descriptive statistics for each of the WHMT factors (i.e., composition, strength, morphology, and physical distance) in the same approach as demographics.

I examined internal reliability, validity, normality, central tendency, and variance for each of the study scales (i.e., ECR-R-GSF, PHQ-9, GAD-7, and SBQ-R). Internal reliability (e.g., Cronbach's alpha and test-retest reliability) can assess the consistency and stability of the measure. The accuracy of the measure is determined by checking its validity (e.g., construct validity and content validity). If any of the measures felt below acceptable reliability, I would conduct further reliability analysis and potentially drop problematic items. The scales for problematic outliers were checked as well. Normality, central tendency, and variance were essential aspects of the distribution of scores on the study scales. I used the Shapiro-Wilk test to assess whether the scores on the study scales were normally distributed. Central tendency was measured through calculating the mean, median, and mode. Finally, the standard deviation was applied to measure variance.

Hypothesis 1: Young adults between 24 to 35 years of age will identify parents as primary attachment figures more often than older adults.

The Chi-square test for association tests was run for this hypothesis. A chi-square test for association was conducted between age ranges and attachment figures. All expected cell frequencies were greater than five. In this case, the categorical independent variable with two

values included (1) 24-35 years of age and (2) greater than 35 years of age. (1) Parents and (2) non-parents were the two values as categorical dependent variables. The variable of frequency (the number of participants for each cell combination) was set up as well. The weight case and crosstabs procedures were conducted in SPSS. The age ranges multiply the attachment figures crosstabulation table was designated to examine the difference between the expected and observed frequencies in each cell.

Hypothesis 2: Adults greater than 65 years of age will identify children as attachment figures more than adults younger than 65.

The Chi-square test for association tests was also used for this hypothesis. In this case, the categorical independent variable with two values contained (1) between 36 and 65 years of age and (2) greater than 65 years of age. (1) Parents and (2) non-parents were the two values as categorical dependent variables. The variable of frequency (the number of participants for each cell combination) was also created. The weight case and crosstabs procedures were conducted in SPSS. The age ranges multiply the attachment figures crosstabulation table was displayed to analyze the difference between the expected and observed frequencies in each cell.

Research Question 1: Do different attachment figures across different age groups positively explain differentiations/differences in mental health?

For attachment composition, the Multivariate Analysis of Covariance (MANCOVA) was run to test effects of composition (categorical independent variable) on depression, anxiety, and suicidal ideation (dependent variables). Age, sex, and romantic relationship status were used as factors. Moreover, SES and attachment quality (ECR) were applied as covariates. The variable of composition was operationalized as the categorical independent variable (i.e., parents, non-parents, romantic partners, friends, and others), and the outcome variables include three continuous variables. I assumed there were moderate intercorrelations among depression,

anxiety, and suicidal ideation. Therefore, these outcomes were entered into a single Multivariate Analysis of Covariance procedure rather than running separate ANCOVAs. The assumption checks of the MANCOVA in this study include independence of observations, univariate or multivariate outliers, multivariate normality, homogeneity of variance, assumptions of linear relationships, and multicollinearity. The observations in each group have to be independent of each other, which means that the relationship between the observations in each group of the independent variable (i.e., parents, non-parents, romantic partners, friends, and others) are not related or connected. Univariate or multivariate outliers were checked, and the Shapiro-Wilk test was used for normality tests. Levene's test was examined for homogeneity of variance, I assumed that there would be equal variances between the groups of the independent variable (i.e., attachment figures) for each independent variable (i.e., depression, anxiety, and suicidal ideation). Multicollinearity was also looked at, and I assumed that the dependent variables would be at least moderately correlated with each other. If anxiety, depression, and suicidal ideation were correlated below 0.4, I would run separate ANCOVAs (Analysis of Covariance) for each dependent variable.

Research Question 2: Does attachment strength for different age groups or sex categories explain differences in adult mental health outcomes, including anxiety, depression, and suicidal ideation?

Hierarchical multiple regression was employed to test this question. The regression is an essential framework for model comparison that is exerted to analyze and indicate if the independent variables of the study explain a statistically significant amount of variance in regard to the dependent variables after considering for all other variables. The analysis was examined to determine whether the results of adult mental health (i.e., PHQ-9, GAD-7, and SBQ-R) were predicted by attachment strength (i.e., the number of attachment figures and emotional distance).

The control variables (i.e., age, sex, and romantic relationship status) were entered in the first block of the regression. The number of attachment figures and emotional distance (the centrality of top three figures) were added in the second block of the regression. I also created interaction terms as the third block of the regression, including the ECR x the number of attachment figures, sex x the number of attachment figures, and romantic relationship status x the number of attachment figures. In addition, the assumption checks in regression analysis were also conducted, which included linearity, normality, homoscedasticity, independence, and multicollinearity. By running these important assumption checks, I ensured the data were appropriate for conducting statistical analysis, and the results of the analysis were accurate and meaningful.

Research Question 3: Does network morphology (monotropic, joint principal, diversified, or distributed network structure pattern) for different age groups or sex categories explain differences in the outcomes of adult mental health, including anxiety, depression, and suicidal ideation?

The MANCOVA was also applied to examine effects of all network structures (i.e., monotropic, joint principal, diversified, or distributed) as categorical variables on depression, anxiety, and suicidal ideation (dependent variables). Age, sex, and romantic relationship status were used as factors for morphology. Attachment quality (ECR) was employed as a covariate. The same assumption checks were examined for both composition and morphology.

Research Question 4: Does physical distance (proximity) for different age groups or sex categories explain differences in adult mental health symptoms, specifically in anxiety, depression, and suicidal ideation?

To examine physical proximity, I run another hierarchical multiple regression to assess whether the outcomes of adult mental health (i.e., depression, anxiety, and suicidal ideation) were predicted by physical proximity (i.e., centrality). Centrality referred to how close the figures are to the respondent, which was calculated by the pixel distance between the respondent

(center) and the top three figures. Choosing the top three attachment figures allows researchers to focus on the most significant and meaningful relationships in an individual's attachment network. By examining the characteristics of the top three attachment figures, researchers can gain a better understanding of the qualities that are most important to individuals in their attachment relationships (i.e., proximity maintenance, safe haven, and secure base). The control variables (i.e., age, sex, and romantic relationship status) were still added in the first block. Physical distance (centrality) and attachment quality (ECR) were entered in the second block. Interaction terms based on the demographic characteristics were conducted as the third block (i.e., age x distance, sex x distance, and romantic relationship status x distance). The interaction between attachment quality and physical distance was also created in the fourth block. The same assumption checks were tested for both attachment strength and physical proximity.

Chapter Four: Results

Overview

This chapter includes an interpretation of the descriptive and inferential statistics, the study findings, and a summary.

Missing Data

There were 1,021 respondents who enrolled in the current study. However, some data on the WHMT assessment was missing, and only a part of the WHMT assessment was displayed in SPSS because of server issues. The server issue had nothing to do with SPSS, but it interfered with participant data being recorded from the internet when they completed the survey. The missing data mainly included the composition of attachment networks and the pixel distance for calculating strength and physical proximity (n = 91). Fifteen respondents were missing all the WHMT data (e.g., case number: 854, 1, 218, 789, 842, 764), and the rest of the respondents (n = 76) were missing part of the WHMT data (e.g., case number: 339, 160, 506, 64, 362, 512). A significant amount of incomplete WHMT data was removed from the study in order to improve accuracy, validity, and maintain error-free data. The valid sample size was 930, which was used for descriptive and inferential statistics and related analyses.

Descriptive Statistics

Descriptive statistics were used to report the age (see Table 1), sex (see Table 2), romantic relationship status (see Table 3), and socioeconomic status (SES; see Table 4) of participants. In addition, all study variables including independent and dependent (outcome) variables were indicated (see Table 5, 6, 7, 9, 10).

Four frequency tables (see Table 1-4) were generated for the demographic variables (i.e., age, sex, romantic relationship status, and socioeconomic status). The age of participants was

divided into four different age groups based on the rationale of developmental age category (Medley, 1980). According to the diverse age groups, male and female had a similar distribution and percentage in each group. The male group had the highest number of people in the early middle age group of 35-44 (n = 145, 36.2 %). Nevertheless, the female group had the largest number of people in the late middle age group of 45-64 (n = 171, 32.3%). The number of married respondents (n = 422, 45.4%) were compared to those who were not married (n = 144, 15.5%). The participants who were not romantically involved with someone or dating had the second largest number of people (n = 253, 27.2%). However, those who were dating with one person had the smallest number of people (n = 111, 11.9%).

In addition, the SES of participants was categorized as working class, lower-middle class, middle class, and upper-middle class (Wani, 2019). Wani's (2019) study discussed how scores that were assigned for each criterion varied based on the level of education, income, and occupation to calculate the SES. Wani (2019) used a modified Kuppuswamy scale to measure the SES, and the categories of educational level were very similar to the scale that I used in this study. However, the categories of income level were based on the monthly income, which displayed higher weighted number of income level than our scale. Therefore, I converted the income level from monthly to annually and matched the score with the categories that I used in this study. The total score of the SES for each participant (i.e., income and educational level) was calculated, and the average score of the two levels was used and converted into a combined SES (Wani, 2019). Almost half of the participants were in the lower-middle class (n = 453, 48.7%), and more than one fourth of the respondents were in the middle class (n = 240, 25.8%).

Composition is the first network metric. In this study, the composition variable was on the basis of "vulnerable self," which referred to how important the attachment figure was to

participants when participants were feeling vulnerable (i.e., felt insecure, unprotected, or emotionally or physically hurt). Table 5 illustrates the frequency and the percentage of respondents that rated diverse categories of important figures as their top three attachment figures (i.e., primary, secondary, tertiary) from 21 available options (i.e., mother, father, romantic partner, best friend and so on). The options of attachment figures were collapsed into five different categories, which included parents (i.e., mother, father, stepmother, and stepfather), nonparents (i.e., brother, sister, aunt, uncle, and grandparents), romantic partners, best friends, and others (i.e., teacher, coach, counselor, son, daughter and so on). Primary attachment to a romantic partner was most common (n = 449, 48.3%), followed by parents (n = 199, 21.4%), best friends, (n = 127, 13.7%), and nonparents (n = 93, 10%). Moreover, parents (n = 316, 34%) and nonparents (n = 291, 31.3%) were most selected as secondary and tertiary attachment respectively.

Furthermore, I broke these primary attachment figures down by the various age groups (i.e., early adulthood, early middle age, late middle age, and late adulthood). Romantic partners were identified as the primary attachment figure for the majority of individuals in any of the age groups. Surprisingly, the proportion of adults who identified their mother as the primary attachment figure had no significant differences in the age groups of early adulthood, early middle age, and late middle age. Nevertheless, individuals who identified others as the primary attachment figure had the highest percentage in the late adulthood (n = 19, 30.6%) compared with those who did in the age group of early adulthood (n = 41, 14.2%) and early middle age group (n = 40, 13.2%). Individuals who selected “others” tended to identify their children as their primary attachment figure; this suggested that children might become increasingly important with age.

Attachment strength, the second network metric for this study, could be measured by the number of attachment figures or emotional distance. Emotional distance was calculated by the average pixel distance of emotional closeness to the center of the WHMT (centrality) among top three figures or all five figures. For the measurement of number of attachment figures, I used a cut-off score to determine the number of attachment figures that placed in the inner circle of the WHMT diagram. Sixty pixels was calculated as the radius of the inner concentric circle and applied as an essential cut-off score. For instance, if the primary figure was equal or less than 60 pixels and the secondary figure was greater than 60 pixels, one attachment figure was indicated (Freeman et al., 2021). It should be noticed that when 60 pixels of the icon was half in the first and the second inner circle, more than half of the icon should be in the first circle to be labeled an attachment figure. Table 6 demonstrates the frequency and the percentage of the number of figures that respondents placed near the center of the diagram. Most of the participants had two attachment figures (n = 310, 33.3%), and the second most common response was one attachment figure (n = 282, 30.3%). Table 9 indicates the mean, the standard deviation, and the test of Shapiro-Wilk P of the number of attachment figures. The average number of attachment figures was 1.96 (M = 1.96, SD = 1.21). In the test of Shapiro-Wilk P, the p-value of the variable was 0.905 ($p > 0.05$). Therefore, the variable was normally distributed.

The third attachment network metric, morphology, was measured in terms of four types of structural patterns. One of the patterns was nonhierarchical (without a clear hierarchy), and the rest of three were hierarchical. The hierarchical patterns consisted of three types of network structures, including monotropic (a primary figure), joint principal (no difference between top two figures), and diversified (differentiation between a primary and secondary figure and between a secondary and tertiary figure), but the nonhierarchical pattern only included

distributed network structure (no preference) (Freeman & Simons, 2018). The network structures were converted and determined based on a cut-off value that indicated a meaningful difference between attachment figures (Freeman et al., 2021). The black icon of each figure measured 18 pixels in radius. Therefore, the cut-off score for considering an attachment figure to be close enough to create one of the four morphology patterns was set at fifteen pixels from another black icon. Table 7 shows the frequency and the percentage of each attachment network structure. More than 40 percent of the respondents had diversified network structures (n = 393, 42.3%). There were over one fourth of the respondents who had monotropic network structures (n = 256, 27.5%).

The fourth attachment network metric, physical proximity (distance), was assessed by the pixel distance between attachment figures and participants (centrality). There were two different ways for calculating the physical distance of centrality, which included the average pixel distance of top three figures or all five figures to the respondent. Table 10 indicates the descriptive statistics for physical distance. The mean physical distance of centrality for top three figures was similar to the distance of only secondary figures to the participant (M = 58.60 and 63.86, SD = 37.57 and 50.07). Based on the Shapiro-Wilk P test, the variable of physical proximity was normally distributed (P = 0.820, p > 0.05).

A correlation matrix was also created to examine whether the age, sex, SES, attachment quality (ECR), attachment strength, morphology of network structures, and physical distance were significantly associated with the outcome variables (see Table 8). Age and SES were statistically and negatively correlated with the mental health outcomes. Older adults and higher SES were connected with less depression, anxiety, and suicidal ideation. Nevertheless, sex was statistically and positively correlated with the results of mental health, which indicated that

female participants were more likely to have depression, anxiety, and suicidal ideation than male participants. Attachment insecurity (ECR) was positively and significantly correlated with depression, anxiety, and suicidal ideation. The higher score of ECR (a more insecure attachment style) was associated with worse mental health status (higher score). Additionally, the number of attachment figures, emotional distance, and attachment hierarchy were all predictive of mental health outcomes.

In addition, the internal consistency reliability for all the continuous scales was examined in terms of Cronbach's Alpha (see Table 9). The internal consistency reliability of the ECR-R scale in this study (Cronbach's α) was 0.82, which was regarded as a very good level. I had 7 items for the anxious scale (Cronbach's α = 0.94) and 4 items for the avoidant scale. Given the few avoidant items, the reliability of avoidant scale was a little lower, but still more than acceptable at 0.82 (Cronbach's α = 0.82). The inter-rater reliability of the ECR-R scale (intraclass correlation coefficient, 0.82; 95% CI, 0.80-0.83) was high. For PHQ-9, Cronbach's alpha was found to be 0.89, which was considered a very satisfactory level. The inter-rater reliability of 0.89 (95% CI, 0.88-0.90) was high. Based on the validity and reliability of GAD-7, internal consistency reliability: Cronbach's alpha was at 0.92, which was considered an excellent level. The inter-rater reliability (intraclass correlation coefficient, 0.92; 95% CI, 0.92-0.93) was high. Additionally, internal consistency reliability of SBQ-R: Cronbach's alpha was over 0.82, which was considered a very good level. The inter-rater reliability (intraclass correlation coefficient, 0.82; 95% CI, 0.80-0.84) was also high.

Hypothesis 1: Young adults between 24 to 35 years of age will identify parents as primary attachment figures more often than older adults.

Hypothesis one focused on the connection between the age groups (24-35 years of age and greater than 35 years of age) and the composition of network structures (parents and

nonparents). A chi-square test for association was conducted between the two age ranges and primary attachment figures (see Table 11). All expected cell frequencies were greater than five, and the minimum expected count was 65.74. There was a not statistically significant association between the age groups and primary attachment figures, $\chi^2(1) = 1.109$, $p = 0.292$ ($p > .05$). Based on the Fisher's Exact test, the result was the same as Pearson's chi-square test ($p = 0.293$). Overall, there was no association between the two different age ranges and primary attachment figures, $\varphi = 0.033$, $p = 0.292$ (see Table 12). Furthermore, although individuals considered their romantic partner as the primary attachment figure in the different age groups, the results from choosing parents as the primary attachment figure illustrated that there were no significant differences in the groups of early adulthood, early middle age, and late middle age. Therefore, there was no sufficient evidence that young adults between 24 to 35 years of age would identify parents as primary attachment figures more often than older adults.

Hypothesis 2: Adults greater than 65 years of age will identify children as attachment figures more than adults younger than 65.

Hypothesis two concentrated on the association between the adult age groups (between 36 and 65 years of age and greater than 65 years of age) and the composition of network structures (parents and nonparents). Children (i.e., son, daughter, grandson, and granddaughter) as attachment figures were explored. The option of "children" was not listed in the WHMT assessment; participants had to write the relationship of children as their attachment figure in the category of "others," which was also included in the category of "nonparents". Based on the number of people selected in "others," 24.4% of the people in early adulthood ($n = 10$) identified their children as attachment figures. In early middle age, 37.5% of the adults ($n = 15$) had an attachment to their children. For late middle age, 27.3% of individuals (n =15) were attached to their children.

A chi-square test for association was also applied between the two age ranges and attachment figures (see Table 13). No expected cell frequencies were less than five, and the minimum expected count was 21.37. There was a statistically significant association between the age groups and attachment figures, $\chi^2(1) = 14.295$, $p < .001$. Based on the Fisher's Exact test, the result was the same as Pearson's chi-square test ($p < .001$). Moreover, the symmetric measures indicated that there was a moderate connection between the two different age ranges and attachment figures, $\varphi = 0.145$, $p < .001$ (see Table 14). According to the table of composition by age, the results indicated adults who selected "others" tended to identify their children as their primary attachment figure in the age group of late adulthood had the largest proportion ($n = 12$, 63.2%). Thus, the results of analysis provided related support that adults greater than 65 years of age would identify children as attachment figures more than adults younger than 65.

Research Question 1: Do different attachment figures across different age groups positively explain differentiations/differences in mental health?

The purpose of this research question was to explore the connections between the composition of attachment networks (the choice of primary attachment figure) and adult mental health outcomes. There were moderate intercorrelations (above 0.4) among depression, anxiety, and suicidal ideation. Therefore, a single Multivariate Analysis of Covariance (MANCOVA) procedure was performed to examine the associations between primary attachment choice (i.e., romantic partners, parents, nonparents, best friends, and others) and anxiety, depression, and suicidal ideation. Moreover, SES and attachment quality (ECR) were applied as covariates. Age, sex, and romantic relationship status were used as factors to determine the moderating effects between the composition and the results of adult mental health.

Preliminary assumption checks indicated that data was normally distributed based on Shapiro-Wilk test ($p < .001$). There were no multivariate outliers, as tested by box plot outliers.

According to Box's M test of equality of covariance matrices, there were not equal variance-covariance matrices ($p < .001$). Therefore, Pillai's trace criterion in the multivariate test was used because the assumption of MANCOVA was violated. Furthermore, based on the Levene's test of equality of error variances, depression (F (124, 805) = 1.56, $p < .001$), anxiety (F (124, 805) = 1.52, $p < .001$), and suicidal ideation (F (124, 805) = 1.90, $p < .001$) were statistically significant, which revealed significant differences between the variances and violated the assumption of homogeneity of variance. To address the assumption violation, I could transform the data to reduce the variability and bring the variances closer to each other.

According to the omnibus test, the primary attachment figure, F (12, 2409) = 0.91, p = 0.533, Pillai's V = 0.01, $\eta^2 = 0.005$, on the combine dependent variables (mental health results) was not statistically significant. However, the effect of attachment quality (ECR) on the combined mental health outcomes was statistically significant, F (3, 801) = 147.03, $p < .001$, Pillai's V = 0.36, $\eta^2 = 0.355$. Sex also had a statistically significant effect on the combined mental health results, F (3, 801) = 3.30, p = 0.02, Pillai's V = 0.01, $\eta^2 = 0.012$. Nevertheless, SES (F (3, 801) = 2.43, p = 0.064, Pillai's V = 0.01, $\eta^2 = 0.009$), age (F (9, 2409) = 1.09, p = 0.367, Pillai's V = 0.01, $\eta^2 = 0.004$), and romantic relationship status (F (9, 2409) = 1.29, p = 0.239, Pillai's V = 0.01, $\eta^2 = 0.005$) on the combine dependent variables were not statistically significant. Additionally, the interactions between composition and age, composition and sex, and composition and romantic relationship status had no statistically significant effects either. Furthermore, the multivariate test (see Table 15) demonstrated a nonsignificant difference between the choice of primary attachment figure (parents versus romantic partners) and depression (F (4, 930) = 1.18, p = 0.32, $\eta^2 = 0.006$), anxiety (F (4, 930) = 1.71, p = 0.15, $\eta^2 = 0.008$), or suicidal ideation (F (4, 930) = 0.89, p = 0.47, $\eta^2 = 0.004$). Furthermore, different age

groups and choice of primary attachment figure had no statistically significant differences between depression (F (12, 930) = 1.48, p = 0.13, η^2 = 0.022) anxiety (F (12, 930) = 1.30, p = 0.21, η^2 = 0.019), and suicidal ideation (F (12, 930) = 1.25, p = 0.24, η^2 = 0.018).

Research Question 2: Does attachment strength for different age groups or sex categories explain differences in adult mental health outcomes, including anxiety, depression, and suicidal ideation?

This research question focused on attachment strength (the number of attachment figures) as a predictor of adult mental health outcomes and age as a potential moderating factor. Attachment strength was measured by two variables, which included the number of attachment figures and the average emotional distance score for the three highest rated attachment figures (centrality). Given the lack of previous literature in this area, no specific hypothesis was generated on whether the strength would predict the outcomes of adult mental health.

The assumption checks were tested. Based on the residual and scatter plots, the assumptions of normality, linearity and homoscedasticity were all satisfied. In addition, a three-model hierarchical multiple regression was run to determine if attachment strength was a possible predictor of anxiety, depression, and suicidal ideation. Age, sex, and romantic relationship status were entered in the first block as control variables. The number of attachment figures and emotional distance (the centrality of top three figures) as attachment strength were added in the second block, and interaction terms were created in the third block.

Attachment Strength as a Predictor of Anxiety

According to the results of the analysis (see Table 19), the addition of the number of attachment figures and emotional distance (centrality) to the prediction of anxiety (model 2) explained a statistically significant amount of variance, R^2 = 0.078, F (2, 924) = 4.387, p = 0.013; adjusted R^2 = 0.073, but accounted for a very small variance (ΔR^2 = 0.009, 0.9%).

Nonetheless, based on the coefficients' summary of the model 2, the variable of number of attachment figures was not a statistically significant predictor of anxiety (B = -0.044, SE = 0.025, β = -0.072, p = 0.082). Emotional distance (centrality) was not statistically significant to the prediction of anxiety either (B = 0.001, SE = 0.001, β = 0.031, p = 0.451).

The results of interaction terms in the model 3 showed a statistically significant amount of variance in anxiety as well, R^2 = 0.251, F (3, 921) = 71.012, p < .001; adjusted R^2 = 0.245, and accounted for a moderate variance (ΔR^2 = 0.173, 17.3%). The interaction between attachment quality (ECR) and the number of attachment figures (B = -0.102, β = -0.439, p < .001) was statistically significant to the prediction of anxiety, which demonstrated a negative interaction effect (more significant for less ECR score-secure attachment). Another interaction term of romantic relationship status and the number of attachment figures (B = 0.032, β = 0.129, p = 0.029) was also statistically significant to the prediction of anxiety, which indicated a positive interaction effect (more significant for the people who were married). However, the interaction between sex and the number of attachment figures (B = -0.010, β = -0.026, p = 0.785) was not statistically significant. In addition, the control variables in the model 1 indicated a statistically significant amount of variance in anxiety, R^2 = 0.069, F (3, 926) = 22.033, p < .001; adjusted R^2 = 0.066, and accounted for 6.9 percent of the variance (ΔR^2 = 0.069). According to the coefficients' summary of the model 1, sex had a statistically significant positive relationship with anxiety (B = 0.331, β = 0.221, p < .001), while age had a statistically significant negative relationship (B = -0.007, β = -0.154, p < .001).

Attachment Strength as a Predictor of Depression

Similarly (see Table 20), the model 2 demonstrated a statistically significant amount of variance in depression after the number of attachment figures and emotional distance (centrality)

were added, $R^2 = 0.073$, F (2, 924) = 8.636, p < .001; adjusted $R^2 = 0.068$, but accounted for a very small variance ($\Delta R^2 = 0.017$, 1.7%). According to the coefficients' summary of the model 2, the variable of number of attachment figures was a statistically significant predictor of depression (B = -0.049, SE = 0.021, β = -0.095, p = 0.022). However, emotional distance (centrality) had no statistically significant effect on depression (B = 0.001, SE = 0.001, β = 0.050, p = 0.223).

The interaction terms for depression in the model 3 led to a statistically significant increase in R^2 of 0.201, F (3, 921) = 84.773, p < .001; adjusted $R^2 = 0.267$, and accounted for a moderate variance ($\Delta R^2 = 0.201$, 20.1%). The interaction between attachment quality (ECR) and the number of attachment figures (B = -0.091, β = -0.473, p < .001) was statistically significant to the prediction of depression, which displayed a negative interaction effect. Another interaction term of romantic relationship status and the number of attachment figures (B = 0.024, β = 0.119, p = 0.042) was also statistically significant to the prediction of depression and had a positive interaction effect. Nevertheless, the interaction between sex and the number of attachment figures (B = -0.002, β = -0.008, p = 0.935) was not statistically significant. Furthermore, the control variables in the model 1 had a statistically significant amount of variance in depression, $R^2 = 0.056$, F (3, 926) = 18.194, p < .001; adjusted $R^2 = 0.053$, and accounted for 5.6 percent of the variance in depression ($\Delta R^2 = 0.056$). Based on coefficients' summary of the model 1, all the demographic characteristics had the same results as the prediction of anxiety.

Attachment Strength as a Predictor of Suicidal Ideation

Finally (see Table 21), the model 2 also indicated a statistically significant amount of variance in suicidal ideation after the two variables of attachment strength were entered, R^2 = 0.038, F (2, 924) = 4.232, p = 0.015; adjusted $R^2 = 0.033$, but accounted for a very small

variance (ΔR^2 = 0.009, 0.9%). Based on the coefficients' summary of the model 2, the variable of number of attachment figures was also a positive and statistically significant predictor of suicidal ideation (B = -0.068, SE = 0.030, β = -0.095, p = 0.024). Nevertheless, emotional distance (centrality) was not a statistically significant predictor of suicidal ideation (B = 0.000, SE = 0.001, β = -0.001, p = 0.987).

The same result displayed that the interaction terms for suicidal ideation in the model 3 was statistically significant with a moderate variance, R^2 = 0.151, F (3, 921) = 40.769, p < .001; adjusted R^2 = 0.143; ΔR^2 = 0.113. The interaction between attachment quality (ECR) and the number of attachment figures (B = -0.094, β = -0.352, p < .001) was statistically significant to the prediction of suicidal ideation (a negative interaction effect), but the interaction term of romantic relationship status and the number of attachment figures (B = 0.029, β = 0.101, p = 0.108) was not statistically significant to the prediction of suicidal ideation. Nevertheless, the interaction between sex and the number of attachment figures (B = 0.094, β = 0.217, p = 0.035) was statistically significant with a positive effect (more significant for male). Additionally, the control variables in the model 1 explained a statistically significant amount of variance in suicidal ideation as well, R^2 = 0.029, F (3, 926) = 9.235, p < .001; adjusted R^2 = 0.026, and accounted for 2.9 percent of the variance in suicidal ideation (ΔR^2 = 0.029).

In summary, the number of attachment figures was a positive statistically significant predictor of depression and suicidal ideation, but not statistically significant predictor of anxiety. Having more attachment figures predicted less depression, anxiety, and suicidal ideation, but there was no significant difference between the number of attachment figures and anxiety. According to the interaction terms, the results indicated that insecurity predicted poor mental health, but it was especially predictive of depression and suicidal ideation when individuals had

more attachment figures. More attachment figures for those with high insecurity (high ECR score) had a negative effect on mental health, and more attachment figures with low insecurity (low ECR score) had a positive relationship to mental health. Additionally, more attachment figures for those who were married had a positive effect on mental health compared to those who were single.

Research Question 3: Does network morphology (monotropic, joint principal, diversified, or distributed network structure pattern) for different age groups or sex categories explain differences in the outcomes of adult mental health, including anxiety, depression, and suicidal ideation?

This research question was to investigate the associations between the shapes of attachment network structures (morphology) and adult mental health outcomes. A single Multivariate Analysis of Covariance (MANCOVA) procedure was run to examine the connections between the network structures (monotropic, joint principal, diversified, and distributed) and anxiety, depression, and suicidal ideation. Furthermore, attachment quality (ECR) was used as a covariate. Age, sex, and romantic relationship status were employed as factors to determine the moderating effects between the morphology and the results of adult mental health.

Preliminary assumption checks showed that data was normally distributed based on Shapiro-Wilk test ($p < .001$). There were no multivariate outliers, as examined by box plot outliers. According to Box's M test of equality of covariance matrices, there was not equal variance-covariance matrices ($p < .001$). Therefore, Pillai's trace criterion in the multivariate test was applied because the assumption of MANCOVA was violated. Additionally, according to the Levene's test of equality of error variances, depression (F (116, 813) = 1.25, $p = 0.05$), anxiety (F (116, 813) = 1.64, $p < .001$), and suicidal ideation (F (116, 813) = 1.89, $p < .001$) were statistically significant, which violated the assumption of homogeneity of the variance.

First, I run a MANCOVA and controlled for emotional distance (centrality of top three figures) as a covariate. I controlled for emotional distance of centrality since it would confound the results for morphology as a predictor of mental health outcomes. Only morphology was used as a factor to investigate the connections between morphology (monotropic, joint principal, diversified, and distributed) and anxiety, depression, and suicidal ideation. The results were found that morphology (F (9, 2775) = 2.454, p = 0.009, Pillai's V = 0.024, η^2 = 0.008) on the combined mental health outcomes was statistically significant. Moreover, the multivariate test (see Table 16) using the morphology patterns (fifteen pixels distance) suggested a statistically significant difference between different network structures and depression (F (3, 930) = 4.869, p = 0.002, η^2 = 0.016), anxiety (F (3, 930) = 4.576, p = 0.003, η^2 = 0.015), and suicidal ideation (F (3, 930) = 3.797, p = 0.010, η^2 = 0.012). Additionally, Bonferroni multiple comparisons of morphology (see Table 17) demonstrated that a distributed network structure was associated with more positive mental health outcomes than a diversified network structure (the mean difference was negative). In other words, less hierarchy was connected with better mental health results. Thus, having preferred attachment figures in the nonhierarchical network structure, compared to the hierarchical networks, was generally associated with better mental health, and the associations were statistically significant.

However, I also conducted another MANCOVA with other control factors (i.e., age, sex, and romantic relationship status), the results showed that morphology (F (9, 2436) = 0.86, p = 0.558, Pillai's V = 0.01, η^2 = 0.003), on the combine mental health outcomes was not statistically significant. Notwithstanding, the effect of attachment quality (ECR) on the combined mental health results was statistically significant, F (3, 810) = 162.76, p < .001, Pillai's V = 0.38, η^2 = 0.376. Sex also had a statistically significant effect on the combined mental health mental health,

F (3, 810) = 2.88, p = 0.04, Pillai's V = 0.01, η^2 = 0.011. However, age (F (9, 2436) = 1.14, p = 0.329, Pillai's V = 0.01, η^2 = 0.004) and romantic relationship status (F (9, 2436) = 1.85, p = 0.055, Pillai's V = 0.02, η^2 = 0.007) on the combine dependent variables were not statistically significant. Furthermore, none of the interaction terms (i.e., morphology x age, morphology x sex, and morphology x romantic relationship status) had statistically significant effects. Moreover, the multivariate test (see Table 18) using the morphology patterns (fifteen pixels distance) indicated a nonsignificant difference between different network structures and depression (F (3, 930) = 0.14, p = 0.938, η^2 = 0.001), anxiety (F (3, 930) = 0.23, p = 0.875, η^2 = 0.001), or suicidal ideation (F (3, 930) = 1.68, p = 0.171, η^2 = 0.006). The network structures with different age groups in a two-way interaction had a statistically significant difference on depression (F (9, 930) = 1.98, p = 0.038, η^2 = 0.022), but not on anxiety (F (9, 930) = 0.78, p = 0.633, η^2 = 0.009), and suicidal ideation (F (9, 930) = 0.98, p = 0.455, η^2 = 0.011).

Research Question 4: Does physical distance (proximity) for different age groups or sex categories explain differences in adult mental health symptoms, specifically in anxiety, depression, and suicidal ideation?

This research question examined physical distance as a predictor of adult mental health outcomes. Given the lack of previous research in this metric, no specific hypothesis was created on whether the centrality of physical distance would predict the outcomes of adult mental health. The assumption checks were tested. According to the residual and scatter plots, the assumptions of normality, linearity and homoscedasticity were all satisfied. Furthermore, a four-model hierarchical multiple regression was conducted to determine if the average physical distance between the participant and the top three attachment figures was a possible predictor of anxiety, depression, and suicidal ideation. Age, sex, and romantic relationship status were entered in the first block as control variables. Physical distance and attachment quality (ECR) were added in

the second block. The interaction terms based on demographic characteristics and attachment quality were created in the third and fourth block respectively.

Physical Distance as a Predictor of Anxiety

Based on the results of the analysis (see Table 22), the addition of attachment quality (ECR) in the model 2 led to a statistically significant increase in R^2 of 0.27, F (2, 924) = 189.191, $p < .001$; adjusted $R^2 = 0.336$, and accounted for a moderate proportion of variance in anxiety ($\Delta R^2 = 0.27$, 27%). Nevertheless, based on the coefficients' summary of the model 2, the variable of physical distance was not a statistically significant predictor of anxiety ($B = -0.001$, SE = 0.002, $\beta = -0.047$, $p = 0.681$). Attachment quality was a positive and statistically significant predictor of anxiety ($B = 0.310$, SE = 0.027, $\beta = 0.555$ $p < .001$).

In addition, the control variables in the model 1 was statistically significant, $R^2 = 0.069$, F (3, 926) = 23.033, $p < .001$; adjusted $R^2 = 0.066$, and accounted for a small proportion of variance in anxiety ($\Delta R^2 = 0.069$, 6.9%). However, romantic relationship status in the model 1 was not statistically significant ($B = 0.028$, SE = 0.019, $p = 0.137$). According to the model 3 and 4, none of results were statistically significant. The interaction terms in the models 3 and 4 were not statistically significant to the prediction of anxiety either.

Physical Distance as a Predictor of Depression

In the same way (see Table 23), when attachment quality (ECR) was entered in the model 2, it also led to a statistically significant increase in R^2 of 0.327, F (2, 924) = 244.677, $p < .001$; adjusted $R^2 = 0.379$, and accounted for a moderate proportion of variance in depression ($\Delta R^2 = 0.327$, 32.7%). However, physical distance to the prediction of depression was not statistically significant either. In terms of the coefficients' summary of the model 2, the variable of physical distance was not a statistically significant predictor of depression ($B = -0.001$, SE = 0.002, β

= .048, p = 0.663). However, attachment quality was also a positive and statistically significant predictor of depression (B = 0.256, SE = 0.022, β = 0.551 p < .001).

Furthermore, the control variables in the model 1 explained a statistically significant amount of variance in depression, R^2 = 0.056, F (3, 926) = 18.194, p < .001; adjusted R^2 = 0.053, and accounted for 5.6 percent variance in depression (ΔR^2 = 0.056). Similarly, the interaction terms for depression in the model 3 and 4 were not statistically significant with very small variances.

Physical Distance as a Predictor of Suicidal Ideation

Lastly (see Table 24), the model 2 indicated a statistically significant amount of variance in suicidal ideation as well after attachment quality (ECR) was added, R^2 = 0.202, F (2, 924) = 100.047, p < .001; adjusted R^2 = 0.198, and accounted for 17.3 percent variance (ΔR^2 = 0.173). Nonetheless, according to the coefficients' summary of the model 2, the variable of physical distance was not a statistically significant predictor of suicidal ideation (B = -0.001, SE = 0.001, β = -0.037, p = 0.215). The same result indicated that attachment quality was a positive and statistically significant predictor of suicidal ideation as well (B = 0.276, SE = 0.020, β = 0.427, p < .001).

Additionally, the control variables in the model 1 also showed a statistically significant amount of variance in suicidal ideation, R^2 = 0.029, F (3, 926) = 9.235, p < .001; adjusted R^2 = 0.026, and accounted for a very small proportion of variance in suicidal ideation (ΔR^2 = 0.029, 2.9%). Based on the model 3 and 4, the same results suggested that physical distance did not interact with age, gender, romantic status, or attachment quality based on the interaction terms.

In conclusion, the physical distance of centrality was a nonsignificant predictor (had no significant effect on all three mental health outcomes) of adult mental health outcomes with no

significant differences among anxiety, depression, and suicidal ideation since we had a large sample size. Surprisingly, close physical distance did not appear to be predictive of any mental health outcomes. However, attachment quality had a strong moderating effect on the relationship between physical distance and adult mental health outcomes.

Chapter Five: Conclusions, Discussions, and Implications

Overview

This chapter provides a summary of the hypotheses and the research questions, as well as a discussion of the current study, implications, and future directions for the research in the ecology of close relationships through the lens of human psychology.

Attachment Network Structures with Adult Mental Health

I examined adult attachment networks from an attachment perspective whether network structures explained connections to mental health. I also investigated whether attachment quality and different age groups had moderating effects on the relationship between the network structures and mental health. The previous literature on close relationships and mental health underscores the importance of dyadic interactions in different types of relationships to mental health, such as parents, best friends, and romantic partners (Daley & Hammen, 2002; Pietromonaco et al., 2013). Moreover, based on attachment theory, the findings also emphasize the significance of children and adolescents forming and maintaining close relationships with their caregivers (e.g., parents) and peers. While attachment relationships and close relationship networks are well-studied in childhood and adolescence, less is known about the importance of these relationships and related networks beyond adolescence and through adulthood. This is considered as a crucial factor in normal development influencing multiple areas of an individual's adult life (Bowlby, 1980; Freeman & Brown, 2001; Mikulciner & Shaver, 2012). The results from the current study indicate adult attachment network structures may explain some associations with mental health outcomes.

Composition of the Network

The first hypothesis in this study addresses whether young adults in early adulthood (24-35 years of age) identify parents as their primary attachment figures more often than older adults. Similar findings provide some evidence to support the premise that people's attachment networks in early adulthood often include parents (Fraley & Davis, 1997; Trinke & Bartholomew, 1997). Based on this study, romantic partners and parents were mostly selected as primary attachment in early adulthood and early middle age. Nevertheless, the number of individuals who chose others over parents as their primary attachment were gradually increased but not significantly until late adulthood. Overall, the percentage of adults who considered their parents as the primary attachment figure had no significant differences in early adulthood, early middle age, and late middle age. Thus, the results did not fully support the hypothesis, and this hypothesized change did not take place until late adulthood. The importance of parents as primary figures through middle age was underestimated because parents remained primary attachment figures much longer than expected among non-romantically involved adults through middle age.

For hypothesis two, I examined whether adults greater than 65 years of age would identify children as attachment figures more than adults younger than 65. Related studies provide some basis to support this hypothesis that primary attachment figures may change during middle and late adulthood. Doherty and Feeney's (2004) study has demonstrated primary attachment to romantic partners and peers are most common to individuals' attachment networks in early adulthood, while in middle to late adulthood, children gradually enter the picture. Children become more essential and meaningful as parent-child relationships are developed, but spouses are still the predominant choice in attachment networks (Antonucci et al., 2004). In the current

study, individuals who considered others as the primary attachment figure had bumped up from late middle age to late adulthood. Individuals who chose "others" tended to identify their children as their primary attachment figure; this suggested that children may become increasingly important with age. In summary, people that considered children as their attachment figure in late adulthood had the largest proportion (n = 12, 63.2%). Moreover, it is worth noting that children represented 63% in the category of "others", but they did not represent 63% of primary figures for this age group. Therefore, the results of analysis supported this hypothesis.

Composition of the Network and Mental Health

The research questions of this study are based on the four metrics of network structures as measured by the WHMT assessment. In the first question, I investigated the association between the composition of an attachment network and the results of adult mental health. There has been a significant amount of research in the importance of attachment figures to adolescent mental health. If adolescents are not able to sustain close relationships and do not have a specific primary attachment figure (e.g., mothers or fathers), there will be mental health problems of anxiety, depression, or suicidal ideation (Bowlby, 1969, 1982; Freeman & Simons, 2018; Steinberg, 2001). In this study, adults have primary attachment figures in their attachment networks. Primary attachment to a romantic partner was most common (n = 449, 48.3%), followed by parents (n = 199, 21.4%), best friends, (n = 127, 13.7%), and nonparents (n = 93, 10%). Nevertheless, there was no statistically significant difference between the choice of romantic partners and parents as primary attachment figures in terms of mental health outcomes. Moreover, different age groups and choice of primary attachment figure had no statistically significant differences between depression, anxiety, and suicidal ideation.

In summary, for this dimension of attachment network structures, we addressed how adults choose their primary attachment figures in terms of the various age groups. Romantic partners are identified as the primary attachment figure for the majority of individuals in any of the age groups. This primacy does not change significantly from young adulthood through late adulthood. Parents are considered as the second top primary attachment figures from early adulthood to late middle age. Surprisingly, the proportion of adults who identified their mother as the primary attachment figure have no significant differences in the age groups of early adulthood, early middle age, and late middle age. Parents have not faded away from attachment networks as quickly as we expected. Most adults in early middle age maintain profound relationships with their parents, although parents may be less involved in the daily lives of their grown-up children. Even in the late middle age, people still maintain close bonds with parents, especially their mother as the primary attachment figure. Notwithstanding, mothers eventually lose status in late adulthood, however, fathers retain the same low percentage throughout adulthood. In addition, best friends do not seem to be as important as we thought until in late middle age. Individuals who identified others as the primary attachment figure had the highest percentage in the late adulthood (n = 19, 30.6%) compared with those who did in the age group of early adulthood (n = 41, 14.2%) and early middle age group (n = 40, 13.2%). Lastly, according to the results of attachment figures related to mental health outcomes, composition of adult attachment networks is not important to mental health outcomes compared to adolescent attachment networks.

Strength of the Network and Mental Health

For question two, I explored whether the network strength as the second metric of network structures could explain differences in mental health outcomes. Attachment strength has

not been widely investigated; thus, I conducted meaningful ways to measure the strength of attachment networks. The strength of network structure was determined by the number of attachment figures or the average emotional distance score for the three highest rated attachment figures (centrality). I found that the number of attachment figures was a positive statistically significant predictor of depression and suicidal ideation but not statistically significant to the prediction of anxiety. Additionally, emotional distance (centrality) as measured by strength also mattered at the bivariate level, but once I controlled for sex, age, and the ECR, strength no longer mattered.

Overall, more attachment figures signified stronger attachment strength. Having more attachment figures predicted less depression, anxiety, and suicidal ideation, but there was no significant difference between the number of attachment figures and anxiety. The results provided support to the related studies that the lack of network strength between individuals and their attachment figures might cause mental health problems such as emotional distress and anxiety (French & Conrad, 2001; Mikulincer & Shaver, 2007).

Morphology of the Network and Mental Health

The patterns of attachment network structures (morphology) was also investigated as the third metric. The metric has not been extensively explored in previous work. I used different methods to measure this metric and explore whether it could also explain differences in the results of mental health and be a possible predictor. I first controlled for emotional distance (centrality) and entered four types of morphology as a single factor. The results indicated a statistically significant difference between different network morphology types and all three mental health outcomes, including depression, anxiety, and suicidal ideation. Surprisingly, the nonhierarchical network, compared to the hierarchical networks, was associated with better

mental health outcomes. Based on attachment theory, it theorizes that having a clear target (attachment figure) for support may be reduced in a distributed network. Equal and diverse support from multiple attachment figures may have positive effects on mental health results. However, when age, sex, and romantic relationship status were added as control factors, the effect of morphology types was nonsignificant. Nevertheless, a morphology by age groups interaction had a statistically significant and positive effect on depression but not on anxiety or suicidal ideation. Individuals in the groups of late middle age and late adulthood with a distributed network structure have less depression.

Related mental health literature have also provided some implications that why non-hierarchical networks are more adaptive and associated with positive mental health. From the perspectives of flexibility and adaptability, having multiple support figures of equal status may promote resilience and the ability to cope with some adversities, which have positive effects on mental health (Reblin & Uchino, 2008). Moreover, more emotional and social support may reduce inequality and increase diversity. This diversity enriches the network's collective power, which may contribute to better mental health outcomes (Reblin & Uchino, 2008).

Physical Proximity (Distance) of the Network and Mental Health

For physical proximity as the fourth dimension of the network structures, this dimension has not thoroughly investigated by previous literature either. In the present study, physical proximity was examined by the average pixel distance of top three figures or all five figures to the participant (centrality). Based on the results, the physical distance of centrality had no significant effect on adult mental health outcomes and no significant differences among anxiety, depression, and suicidal ideation. The amount of physical distance from close relationships did not appear to be predictive of mental health. The findings of physical distance to mental health

outcomes suggest that close geographic location does not appear to be a good predictor of people's mental health well-being. Unexpectedly, close physical distance even predicts a more negative effect on depression, anxiety, and suicidal ideation. This is a little bit strange in that one would think being further away from one's closest attachment figures would cause some anxiety or depression. But on the whole, the result in this study does not appear to be the case. As discussed earlier, one of the inclusionary criteria in this study included the participants who were currently living in the same residence in which they have lived during most of the COVID-19 pandemic. Thus, one of the possible reasons is that the time during the pandemic may have helped individuals adapt to close others living far away. The findings indicate that technology may be able to bridge the physical divide, such that people can still maintain close relationships with their attachment figures using video chat and other social media platforms.

Additionally, it is interesting that Ben-Ari's (2012) study has discussed the relationship between distance and closeness as the "paradox" in intimate relationships. Physical proximity is based on the physical environment. If people are closer in a physical environment, they are more likely to build close relationships (Kiesler & Cummings, 2002; Ben-Ari, 2012). Nevertheless, those of people in a secure attachment may feel even more affection when they are apart from their close figures in the short period of time, especially in romantic relationships (Jiang & Hancock, 2013; Ellis & Ledbetter, 2015; Pellegrini, 1977). One of the reasons may be that when two people are physically separated, they may experience a sense of longing and yearning for each other's company. This longing can intensify emotions and create a deeper appreciation for the relationship.

In conclusion, the metrics of attachment network structure as measured by the WHMT were predictive of adult mental health in some extent. Specifically, both strength and

morphology were predictive at the bivariate level and even in the ANOVAs; but once the ECR was accounted for, the structure variables lost significance. Nonetheless, attachment quality (ECR) in the main effects had a strong moderating effect on the relationship between attachment network structures and adult mental health outcomes.

Limitations

The limitations of this study are due to a restricted sample (Amazon Mechanical Turk workers), self-reported instruments, and temporal restrictions due to cross-sectional data.

A restricted sample is the first limitation. Respondents in the present study were recruited from a convenience sample of MTurk workers. Although a large sample size was included in this study, the sample size had a small population in terms of diversity. There are a great number of Mechanical Turk workers who participate in academic research every year, and many of the active workers even complete over hundreds of assignments or studies every month (Chandler et al., 2014). The consequence of this situation is that MTurk workers are continuously recycled across different academic studies (Chandler et al., 2014; Goodman et al., 2013). Most of the MTurk participants have had extensive experience in answering a variety of surveys or questionnaires, which may affect the validity of the study and data quality (Chandler et al., 2014; Peer et al., 2014). Furthermore, MTurk workers may not represent the general US population or may be limited to certain demographic groups. Because of the limited diversity of the sample, the results may not be generalizable to the broader population, which may have an effect on the external validity of the study (Peer et al., 2014). Selective recruitment is necessary, and a more diverse sample that is not limited to MTurk workers needs to be considered.

The biases of self-reported instruments are considered as the second limitation of this study. The scores from the measures applied in this study were based upon self-report, which is

limited to what participants are able and willing to report. This means that some information may be missed, such as subconscious attitudes or behaviors that the respondent may not be aware of. For instance, based on mental health outcomes, self-reported answers sometimes may be exaggerated. Respondents may not accurately reflect how they feel based on anxiety, depression, and suicidal ideation, and they may subjectively feel bad when they answer the survey questions. Moreover, participants may not want to reveal their private details either. In addition, the answers to emotional questions may be hard to fully capture in the survey because of the complex construct.

The third limitation to this study is about cross-sectional data. We only filled up the related gap based on the phase one dataset. Although the phase two dataset was also collected, the current study did not employ a longitudinal design. Based on cross-sectional data, it is difficult to address questions about stability, dynamics, and change of attachment network structures measured by the WHMT diagram. In a longitudinal study, we can better understand why the network structures are stable or not, and if not, why and how they change over time. Moreover, very little is understood on how the stability and change of attachment network structures are associated with mental health outcomes. In the future study, a longitudinal design of attachment networks structures and mental health outcomes is necessary.

Future Directions and Implications

As discussed above, we need to consider how to examine the relative stability of adults' preferences for attachment figures or why and how these figures change within a short period of time. Furthermore, we also need to address how adults restructure and reorganize their hierarchical or nonhierarchical network structures over time. To better understand and tackle

these questions, a longitudinal study of how attachment network structures are associated with mental health and well-being is needed, which should be a new focus in the future investigations.

In addition, the mental health problems of this study are based on depression, anxiety, and suicidal ideation. Although related background of these problems was provided in the chapter one, we should not be limited to these outcomes of mental health. Other issues related to mental health may need to be explored, such as emotional distress, social isolation, and loneliness.

Lastly, we measured attachment network structures by the WHMT assessment and examined the four metrics of network structures separately. Notwithstanding, it is unclear whether we can used mixed methods to investigate two metrics simultaneously (e.g., emotional and physical distance). For instance, we can ask questions to determine whether the attachment figures that participants choose are both emotionally and physically close to them, or only emotionally close to them. In this case, we can examine whether those who have strong attachment strength with close physical distance have different mental health outcomes compared to those who only have strong attachment strength. Furthermore, additional study is required to provide evidence that the WHMT is an effective measurement to assess whether adults are experiencing mental health problems by their attachment network structures.

Conclusion

The results of the present study shed new light on how adult attachment network structures are predictive of mental health outcomes, which is a good breakthrough. The findings provide some confirmation that choosing different primary attachment figures are not significant to mental health outcomes in adult attachment networks. Moreover, more than one attachment figure is connected with positive mental health outcomes. However, the nonhierarchical network

structure predicted even better mental health outcomes. Additionally, the amount of physical distance from close relationships does not appear to be a good predictor of mental health.

Overall, the findings reveal a more comprehensive network perspective of close relationships than what previous literature has uncovered. Up until now, the research on the impact of close relationships on mental health has limited to dyadic interactions in different types of relationships. Moreover, most of the studies have only focused on network composition, or who is the primary attachment figure. The results of this study provide a more complete network perspective by examining the ecology of close relationships from the angle of attachment and human psychology. This gives researchers a more comprehensive understanding of how close relationship networks are associated with mental health outcomes.

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Table 1

Age of Participants

	Male		Female		Total	
Age	*n*	*%*	*n*	*%*	*n*	*%*
22-34	126	31.4	162	30.6	288	31.0
35-44	145	36.2	159	30.1	304	32.7
45-64	105	26.2	171	32.3	276	29.7
65 and older	25	6.2	37	7.0	62	6.7
Total	401	100	529	100	930	100

Table 2

Sex of Participants

Sex	*n*	*%*
Male	401	43.1
Female	529	56.9
Total	930	100

Table 3

Romantic Relationship Status of Participants

Romantic Relationship Status	*n*	*%*
Married	422	45.4
Not Married (Engaged or Living with the partner)	144	15.5
Dating with one person (Seriously or Not seriously)	111	11.9
Single	253	27.2
Total	930	100

Table 4

Socioeconomic Status (SES) of Participants

SES	*n*	*%*
Working Class	138	14.8
Lower-Middle Class	453	48.7
Middle Class	240	25.8
Upper-Middle Class	99	10.6
Total	930	100

Table 5-1

Composition Collapsed Category Results for Attachment Figure

	Primary Figure		Secondary Figure		Tertiary Figure	
Category	*n*	*%*	*n*	*%*	*n*	*%*
Parents	199	21.4	316	34.0	281	30.2
Nonparents	93	10.0	220	23.7	291	31.3
Romantic Partners	449	48.3	86	9.2	51	5.5
Best Friends	127	13.7	215	23.1	255	27.4
Others	62	6.7	93	10.0	52	5.6
Total	930	100	930	100	930	100

Table 5-2

Composition Collapsed Category Results for Attachment Figure Based on Sex

	Primary Figure			
	Male		Female	
Category	*n*	*%*	*n*	*%*
Parents	115	28.7	84	15.9
Nonparents	32	8.0	61	11.5
Romantic Partners	195	48.6	254	48.0
Best Friends	45	11.2	82	15.5
Others	14	3.5	48	9.1
Total	401	100	529	100

	Tertiary Figure			
	Male		Female	
Category	*n*	*%*	*n*	*%*
Parents	131	32.7	150	28.4
Nonparents	123	30.7	168	31.8
Romantic Partners	20	5.0	31	5.9
Best Friends	116	28.9	139	26.3
Others	11	2.7	41	7.8
Total	401	100	529	100

	Secondary Figure			
	Male		Female	
Category	*n*	*%*	*n*	*%*
Parents	154	38.4	162	30.6
Nonparents	84	20.9	136	25.7
Romantic Partners	22	5.5	64	12.1
Best Friends	106	26.4	109	20.6
Others	35	8.7	58	11.0
Total	401	100	529	100

Table 5-3

Composition Collapsed Category Results for Attachment Figure Based on Age

Age Group	Primary Attachment Figure	*n*	*%*
Early Adulthood (ages 22-34)	Mother	52	18.1
	Father	13	4.5
	Romantic Partner	141	49.0
	Best Friend	41	14.2
	Others	41	14.2
	Total	288	100.0
Early Middle Age (ages 35-44)	Mother	53	17.4
	Father	22	7.2
	Romantic Partner	158	52.0
	Best Friend	31	10.2
	Others	40	13.2
	Total	304	100
Late Middle Age (ages 45-64)	Mother	41	14.9
	Father	13	4.7
	Romantic Partner	122	44.2
	Best Friend	45	16.3
	Others	55	19.9
	Total	276	100.0
Late Adulthood (ages 65 and older)	Mother	2	3.2
	Father	3	4.8
	Romantic Partner	28	45.2
	Best Friend	10	16.1
	Others	19	30.6
	Total	62	100.0

Table 6

Attachment Strength-Number of Attachment Figures in the Inner Circle

Number of Figures	*n*	*%*
0.00	76	8.2
1.00	282	30.3
2.00	310	33.3
3.00	169	18.2
4.00	48	5.2
5.00	45	4.8
Total	930	100

Table 7

Morphology-Attachment Network Structures for Attachment Hierarchy

Network Structure	*n*	*%*
Monotropic	256	27.5
Joint Principal	160	17.2
Diversified	393	42.3
Distributed	121	13.0
Total	930	100

Note. Categories are based on differences between
n three highest rated figures.

Table 8

Descriptive Statistics and Correlations for Study Variables

Variable	*n*	1	2	3	4	5	6	7	8	9	10	11	12	13
1.Number of Attachment Figures	930	-												
2.Morphology (Hierarchical vs Non-hierarchical)	930	-.27**	-											
3.Emotional Distance (Centrality-All Five)	930	-.66**	.20**	-										
4.Emotional Distance (Centrality-Top Three)	930	-.64**	.15**	.92**	-									
5.Physical Distance (Centrality-All Five)	930	-.17**	.06	.29**	.27**	-								
6.Physical Distance (Centrality-Top Three)	930	-.13**	.05	.21**	.22**	.91**	-							
7.Attachment Quality (ECR)	930	-.22**	.08*	.22**	.18**	.04	.012	-						
8.Depression	930	-.13**	.09**	.16**	.11**	.04	.003	.60**	-					
9.Anxiety	930	-.08**	.09**	.11**	.06	.003	-.02	.56**	.78**	-				
10.Suicidal Ideation	930	-.10**	.06	.11**	.06	.003	-.05	.43**	.51**	.43**	-			
11.Age	930	.03	.01	-.01	-.001	.12**	.13**	-.18**	-.16**	-.17**	-.12**	-		
12.Sex	930	.10**	-.03	-.06	-.08*	.03	.03	.07*	.12**	.21**	.05	.05	-	
13.SES	930	-.003	.01	-.02	.00	.03	.04	-.11**	-.16**	-.11**	-.14**	.05	-.09**	-

**. Correlation is significant at the 0.01 level ($p < .01$, 2-tailed).

*. Correlation is significant at the 0.05 level ($p < .05$, 2-tailed).

Table 9

Descriptive Statistics for Continuous Variables

Variable	*n*	*M*	*SD*	*Cronbach's Alpha*	*Skewness*	*Kurtosis*	*Shapiro-Wilk*
Age	930	42.71	15.59	N/A	8.08	148.93	0.667
Attachment Strength (NAF)	930	1.96	1.21	N/A	0.63	0.18	0.905
Depression	930	1.62	0.62	0.891	1.13	0.76	0.875
Anxiety	930	1.68	0.74	0.924	1.16	0.62	0.849
Suicidal Ideation	930	1.57	0.86	0.821	1.91	3.46	0.710
Attachment Quality (ECR)	930	3.50	1.32	0.816	0.16	-0.68	0.986
Emotional Distance	930	91.62	45.99	N/A	2.38	9.22	0.814
Physical Distance	930	91.62	41.67	N/A	1.46	5.00	0.920

Note. M and SD are used to represent mean and standard deviation, respectively.

Table 10

Descriptive Statistics for Emotional and Physical Distance

Variable		*n*	*M*	*SD*	*Skewness*	*Kurtosis*	*Shapiro-Wilk*
Emotional Distance	Primary Figure	930	24.53	31.69	4.674	38.165	0.637
	Secondary Figure	930	62.51	50.95	3.716	17.982	0.649
	Tertiary Figure	930	91.21	55.62	2.484	9.082	0.788
	Quaternary Figure	930	122.67	61.89	1.685	4.390	0.869
	Quinary Figure	930	157.18	71.81	1.935	9.579	0.877
	Centrality (All Five)	930	91.62	45.99	2.378	9.215	0.814
	Centrality (Top Three)	930	59.41	40.33	3.350	16.456	0.713
Physical Distance	Primary Figure	930	18.56	30.90	4.378	32.871	0.575
	Secondary Figure	930	63.86	50.07	1.750	5.131	0.869
	Tertiary Figure	930	93.38	53.83	1.195	2.326	0.924
	Quaternary Figure	930	123.71	61.10	1.043	1.750	0.940
	Quinary Figure	930	158.61	66.17	1.266	5.652	0.933
	Centrality (All Five)	930	91.62	41.67	1.459	5.004	0.920
	Centrality (Top Three)	930	58.60	37.57	2.117	9.863	0.863

Table 11

Chi-Square Tests for Hypothesis 1

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.109[a]	1	0.292		
Continuity Correction [b]	0.939	1	0.333		
Likelihood Ratio	1.096	1	0.295		
Fisher's Exact Test				0.293	0.166
Linear-by-Linear Association	1.108	1	0.293		
N of Valid Cases	930				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 65.74.
b. Computed only for a 2x2 table.

Table 12

Symmetric Measures for Hypothesis 1

		Value	Approximate Significance
Nominal by Nominal	Phi	0.033	0.292
	Cramer's V	0.033	0.292
N of Valid Cases		930	

Table 13

Chi-Square Tests for Hypothesis 2

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	14.295[a]	1	< .001		
Continuity Correction [b]	13.318	1	< .001		
Likelihood Ratio	17.563	1	< .001		
Fisher's Exact Test				< .001	< .001
Linear-by-Linear Association	14.274	1	< .001		
N of Valid Cases	611				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 65.74.
b. Computed only for a 2x2 table.

Table 14

Symmetric Measures for Hypothesis 2

		Value	Approximate Significance
Nominal by Nominal	Phi	0.145	< .001
	Cramer's V	0.145	< .001
N of Valid Cases		611	

Table 15

MANCOVA-Tests of Between-Subjects Effects-Composition

	Dependent Variable	Sum of Squares	df	Mean Square	F	p	η^2
Intercept	Depression	21.23	1	21.23	92.71	< .001	.104
	Anxiety	17.08	1	17.08	48.37	< .001	.057
	Suicidal Ideation	23.01	1	23.01	39.70	< .001	.047
Attachment Quality	Depression	86.63	1	86.63	378.29	< .001	.320
	Anxiety	104.04	1	104.04	294.59	< .001	.268
	Suicidal Ideation	85.57	1	85.57	147.67	< .001	.155
SES	Depression	1.39	1	1.39	6.09	0.014	.008
	Anxiety	0.81	1	.81	2.29	0.131	.003
	Suicidal Ideation	2.03	1	2.03	3.50	0.062	.004
Primary Figures	Depression	1.08	4	0.27	1.18	0.320	.006
	Anxiety	2.42	4	0.60	1.71	0.146	.008
	Suicidal Ideation	2.05	4	0.51	0.89	0.472	.004
Age	Depression	0.73	3	0.24	1.06	0.367	.004
	Anxiety	2.60	3	0.87	2.45	0.062	.009
	Suicidal Ideation	2.35	3	0.78	1.35	0.257	.005
Sex	Depression	0.57	1	0.57	2.47	0.117	.003
	Anxiety	3.31	1	3.31	9.38	0.002	.012
	Suicidal Ideation	0.03	1	0.03	0.06	0.807	.000
Romantic R Status	Depression	1.68	3	0.56	2.44	0.063	.009
	Anxiety	1.40	3	0.47	1.32	0.266	.005
	Suicidal Ideation	0.67	3	0.22	0.39	0.763	.001
Primary Figures * Age	Depression	4.07	12	0.34	1.48	0.126	.022
	Anxiety	5.50	12	0.46	1.30	0.215	.019
	Suicidal Ideation	8.71	12	0.73	1.25	0.243	.018
Primary Figures * Sex	Depression	0.31	4	0.08	0.33	0.856	.002
	Anxiety	0.84	4	0.21	0.60	0.665	.003
	Suicidal Ideation	3.17	4	0.79	1.37	0.243	.007
Primary Figures * RRS	Depression	4.16	12	0.35	1.52	0.113	.022
	Anxiety	6.71	12	0.56	1.58	0.091	.023
	Suicidal Ideation	5.45	12	0.45	0.78	0.668	.012

Table 16

MANCOVA-Tests of Between-Subjects Effects-Morphology (Controlling for Emotional Distance)

	Dependent Variable	Sum of Squares	df	Mean Square	F	p	η^2
Intercept	Depression	644.42	1	644.42	1740.67	< .001	.653
	Anxiety	723.55	1	723.55	1338.22	< .001	.591
	Suicidal Ideation	612.16	1	612.16	846.00	< .001	.478
Emotional Distance (Centrality)	Depression	3.33	1	3.33	8.98	.003	.010
	Anxiety	1.29	1	1.29	2.38	.123	.003
	Suicidal Ideation	1.89	1	1.89	2.62	.106	.003
Morphology	Depression	5.41	3	1.80	4.87	.002	.016
	Anxiety	7.42	3	2.47	4.58	.003	.015
	Suicidal Ideation	8.24	3	2.75	3.80	.010	.012

Table 17

Bonferroni Multiple Comparisons of Morphology

Dependent Variable	(I) Morphology	(J) Morphology	Mean Difference (I-J)	Std. Error	Sig (p-value)
Depression	Distributed	Monotropy	-0.078	0.067	1.000
		Joint Principal	-0.090	0.074	1.000
		Diversified	-0.219*	0.064	0.004
Anxiety	Distributed	Monotropy	-0.108	0.081	1.000
		Joint Principal	-0.111	0.089	1.000
		Diversified	-0.259*	0.077	0.004
Suicide Ideation	Distributed	Monotropy	-0.215	0.094	0.133
		Joint Principal	-0.274*	0.103	0.046
		Diversified	-0.304*	0.089	0.004

Table 18

MANCOVA-Tests of Between-Subjects Effects-Morphology

	Dependent Variable	Sum of Squares	df	Mean Square	F	p	η^2
Intercept	Depression	36.16	1	36.16	158.65	< .001	.163
	Anxiety	26.96	1	26.96	75.92	< .001	.086
	Suicidal Ideation	29.33	1	29.33	50.28	<. 001	.058
Attachment Quality	Depression	93.25	1	93.25	409.13	< .001	.335
	Anxiety	114.94	1	114.94	323.70	< .001	.285
	Suicidal Ideation	100.15	1	100.15	171.68	< .001	.175
Morphology	Depression	0.09	3	0.03	0.14	.938	.001
	Anxiety	0.25	3	0.08	0.23	.875	.001
	Suicidal Ideation	2.93	3	0.98	1.68	.171	.006
Age	Depression	0.66	3	0.22	0.96	.409	.004
	Anxiety	1.80	3	0.60	1.69	.168	.006
	Suicidal Ideation	0.49	3	0.16	0.28	.839	.001
Romantic R Status	Depression	0.51	3	0.17	0.74	.529	.003
	Anxiety	1.75	3	0.58	1.64	.179	.006
	Suicidal Ideation	0.77	3	0.26	0.44	.724	.002
Sex	Depression	0.01	1	0.01	0.03	.863	.000
	Anxiety	1.87	1	1.87	5.28	.022	.006
	Suicidal Ideation	0.06	1	0.06	0.10	.754	.000
Morphology * Age	Depression	4.07	9	0.45	1.98	.038	.022
	Anxiety	2.50	9	0.28	0.78	.633	.009
	Suicidal Ideation	5.15	9	0.57	0.98	.455	.011
Morphology * RRS	Depression	1.64	9	0.18	0.80	.616	.009
	Anxiety	3.01	9	0.33	0.94	.488	.010
	Suicidal Ideation	2.93	9	0.33	0.56	.832	.006
Morphology * Sex	Depression	0.86	3	0.29	1.25	.289	.005
	Anxiety	1.36	3	0.45	1.28	.281	.005
	Suicidal Ideation	2.79	3	0.93	1.60	.189	.006

Table 19

Summary of Hierarchical Multiple Regression for Attachment Strength Predicting Anxiety

	Variable	*B*	*β*	*R*	R^2	ΔR^2	Sig (p-value)
Model 1	Control Variables	1.416**		0.264	0.069	0.069	< .001
	Age	-.007**	-.154				
	Romantic Relationship Status	.028	.047				
	Sex	.331**	.221				
Model 2	Independent Variable	1.461**		0.280	0.078	0.009	.013
	Age	-.007**	-.154				
	Romantic Relationship Status	.022	.038				
	Sex	.343**	.230				
	The Number of Attachment Figures	-.044	-.072				
	Emotional Distance (Centrality-Top Three Figures)	.001	.031				
Model 3	Interaction Terms	1.351**		0.501	0.251	0.173	< .001
	Age	-.005**	-.104				
	Romantic Relationship Status	-.011	-.020				
	Sex	.270**	.181				
	The Number of Attachment Figures	.072	.117				
	Emotional Distance (Centrality-Top Three Figures)	.001	.031				
	ECR * Strength	-.102**	-.439				
	Romantic Relationship Status * Strength	.032*	.129				
	Sex * Strength	-.010	-.026				

*Note. N=930. * p < .05 ** p < .001*

Table 20

Summary of Hierarchical Multiple Regression for Attachment Strength Predicting Depression

	Variable	*B*	*β*	*R*	R^2	ΔR^2	Sig (p-value)
Model 1	Control Variables	1.430**		0.236	0.056	0.056	< .001
	Age	-.006**	-.142				
	Romantic Relationship Status	.065**	.134				
	Sex	.182**	.147				
Model 2	Independent Variable	1.472**		0.270	0.073	0.017	< .001
	Age	-.006**	-.142				
	Romantic Relationship Status	.058**	.121				
	Sex	.197**	.159				
	The Number of Attachment Figures	-.049*	-.095				
	Emotional Distance (Centrality-Top Three Figures)	.001	.050				
Model 3	Interaction Terms	1.369**		0.523	0.274	0.201	< .001
	Age	-.003*	-.088				
	Romantic Relationship Status	.029*	.059				
	Sex	.132**	.106				
	The Number of Attachment Figures	.057	.111				
	Emotional Distance (Centrality-Top Three Figures)	.001	.052				
	ECR * Strength	-.091**	-.473				
	Romantic Relationship Status * Strength	.024*	.119				
	Sex * Strength	-.002	-.008				

*Note. N=930. * $p < .05$ ** $p < .001$*

Table 21

Summary of Hierarchical Multiple Regression for Attachment Strength Predicting Suicidal Ideation

	Variable	*B*	*β*	*R*	R^2	ΔR^2	Sig (p-value)
Model 1	Control Variables	1.497**		0.170	0.029	0.029	< .001
	Age	-.006**	-.116				
	Romantic Relationship Status	.073**	.109				
	Sex	.114*	.066				
Model 2	Independent Variable	1.622**		0.195	0.038	0.009	.015
	Age	-.006**	-.116				
	Romantic Relationship Status	.067*	.099				
	Sex	.128*	.074				
	The Number of Attachment Figures	-.068*	-.095				
	Emotional Distance (Centrality-Top Three Figures)	.000	-.001				
Model 3	Interaction Terms	1.195**		0.388	0.151	0.113	< .001
	Age	-.004*	-.075				
	Romantic Relationship Status	.035	.051				
	Sex	.057	.033				
	The Number of Attachment Figures	.204*	.288				
	Emotional Distance (Centrality-Top Three Figures)	.000	.010				
	ECR * Strength	-.094**	-.352				
	Romantic Relationship Status * Strength	.029	.101				
	Sex * Strength	.094*	.217				

*Note. N=930. * p < .05 ** p < .001*

Table 22

Summary of Hierarchical Multiple Regression for Physical Distance Predicting Anxiety

	Variable	*B*	*β*	*R*	R^2	ΔR^2	Sig (p-value)
Model 1	Control Variables	1.416**		0.264	0.069	0.069	< .001
	Age	-.007**	-.154				
	Romantic Relationship Status	.028	.047				
	Sex	.331**	.221				
Model 2	Independent Variable	0.484**		0.583	0.340	0.270	< .001
	Age	-.003*	-.070				
	Romantic Relationship Status	-.028	-.048				
	Sex	.257**	.172				
	Physical Distance	-.001	-.040				
	Attachment Quality (ECR)	.299**	.535				
Model 3	Interaction Terms	0.494*		0.584	0.341	0.001	.657
	Age	-.004*	-.075				
	Romantic Relationship Status	-.028	-.049				
	Sex	.263**	.176				
	Physical Distance	-.001	-.046				
	Attachment Quality (ECR)	.299**	.535				
	Age * Distance	.000	.054				
	Romantic Relationship Status * Distance	.000	.038				
	Sex * Distance	-.001	-.093				
Model 4	Interaction Terms	0.459*		0.584	0.341	0.000	.616
	Age	-.004*	-.077				
	Romantic Relationship Status	-.028	-.048				
	Sex	.262**	.176				
	Physical Distance	-.001	-.047				
	Attachment Quality (ECR)	.310**	.555				
	Age * Distance	.000	.064				
	Romantic Relationship Status * Distance	.000	.027				
	Sex * Distance	-.001	-.093				
	ECR * Distance	.000	.025				

*Note. N=930. * $p < .05$ ** $p < .001$*

Table 23

Summary of Hierarchical Multiple Regression for Physical Distance Predicting Depression

	Variable	*B*	*β*	*R*	R^2	ΔR^2	Sig (p-value)
Model 1	Control Variables	1.430**		0.236	0.056	0.056	< .001
	Age	-.006**	-.142				
	Romantic Relationship Status	.065**	.134				
	Sex	.182**	.147				
Model 2	Independent Variable	0.579**		0.619	0.383	0.327	< .001
	Age	-.002	-.050				
	Romantic Relationship Status	.014	.029				
	Sex	.115**	.093				
	Physical Distance	-.001	-.045				
	Attachment Quality (ECR)	.273**	.588				
Model 3	Interaction Terms	0.488**		0.620	0.384	0.002	.505
	Age	-.002	-.053				
	Romantic Relationship Status	.014	.029				
	Sex	.120**	.097				
	Physical Distance	.001	.046				
	Attachment Quality (ECR)	.273**	.589				
	Age * Distance	.000	.055				
	Romantic Relationship Status * Distance	.000	.071				
	Sex * Distance	.000	-.023				
Model 4	Interaction Terms	0.543**		0.620	0.385	0.001	.333
	Age	-.002	-.050				
	Romantic Relationship Status	.013	.028				
	Sex	.121**	.097				
	Physical Distance	.001	.048				
	Attachment Quality (ECR)	.256**	.551				
	Age * Distance	.000	.035				
	Romantic Relationship Status * Distance	.001	.090				
	Sex * Distance	.000	-.022				
	ECR * Distance	.000	-.047				

*Note. N=930. * p < .05 ** p < .001*

Table 24

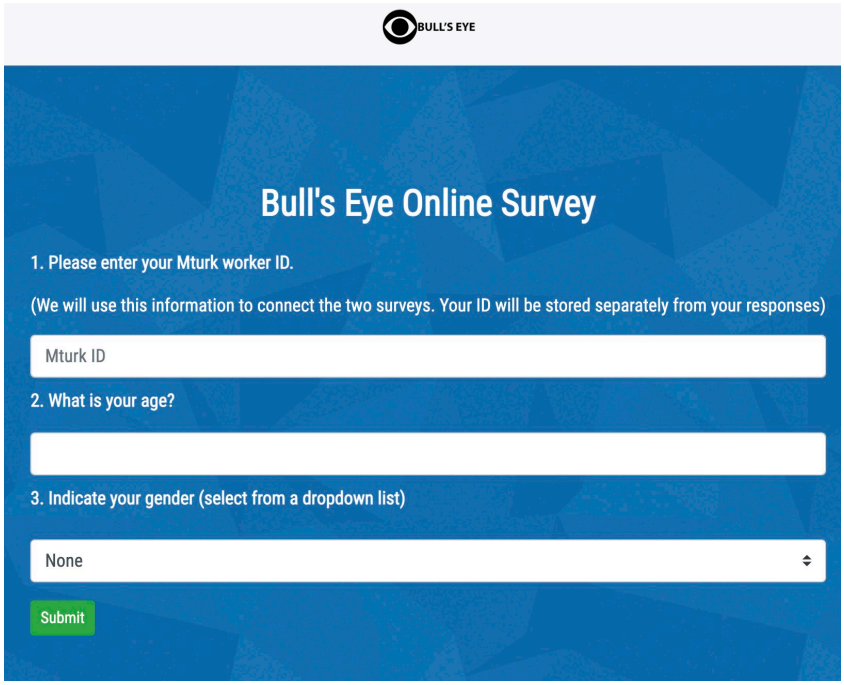
Summary of Hierarchical Multiple Regression for Physical Distance Predicting Suicidal Ideation

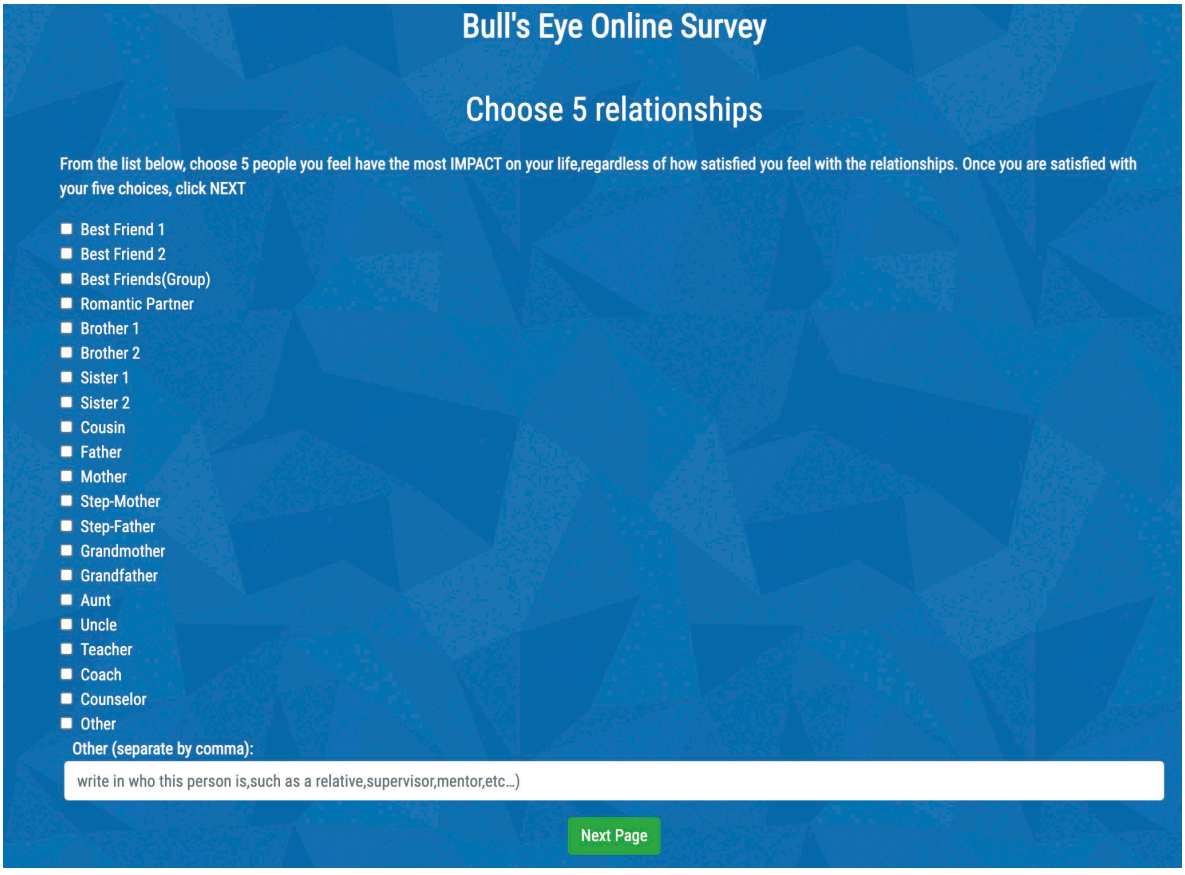
	Variable	*B*	*β*	*R*	R^2	ΔR^2	Sig (p-value)
Model 1	Control Variables	1.497**		0.170	0.029	0.029	< .001
	Age	-.006**	-.116				
	Romantic Relationship Status	.073**	.109				
	Sex	.114*	.066				
Model 2	Independent Variable	0.641**		0.449	0.202	0.173	< .001
	Age	-.003	-.049				
	Romantic Relationship Status	.022	.033				
	Sex	.046	.027				
	Physical Distance	-.001	-.037				
	Attachment Quality (ECR)	.276**	.427				
Model 3	Interaction Terms	0.712**		0.452	0.204	0.002	.448
	Age	-.003	-.052				
	Romantic Relationship Status	.020	.030				
	Sex	.055	.032				
	Physical Distance	-.002	-.091				
	Attachment Quality (ECR)	.277**	.429				
	Age * Distance	.000	.039				
	Romantic Relationship Status * Distance	.000	.054				
	Sex * Distance	-.002	-.145				
Model 4	Interaction Terms	0.729*		0.452	0.204	0.000	.844
	Age	-.003	-.051				
	Romantic Relationship Status	.020	.030				
	Sex	.055	.032				
	Physical Distance	-.002	-.091				
	Attachment Quality (ECR)	.271**	.420				
	Age * Distance	.000	.035				
	Romantic Relationship Status * Distance	.001	.059				
	Sex * Distance	-.002	-.145				
	ECR * Distance	-.000	-.011				

*Note. N=930. * $p < .05$ ** $p < .001$*

Appendix A

Web-Based Hierarchical Mapping Technique (WHMT)





Web-Based Hierarchical Mapping Technique (WHMT) Assessment (continued)

Vulnerable Self Target

How important is each person to you when you are feeling vulnerable? You are vulnerable when you feel insecure, unprotected, or emotionally or physically hurt.

Drag and drop each person into the circle so that the most important person is the closest to "YOU" when you feel vulnerable."

When you are finished click the Proceed button.

BFG - for BestFriends(Group) RP - for RomanticPartner F - for Father M - for Mother T - for Teacher

BFG

RP

F

M

T

Proceed To the Next Page

Web-Based Hierarchical Mapping Technique (WHMT) Assessment (continued)

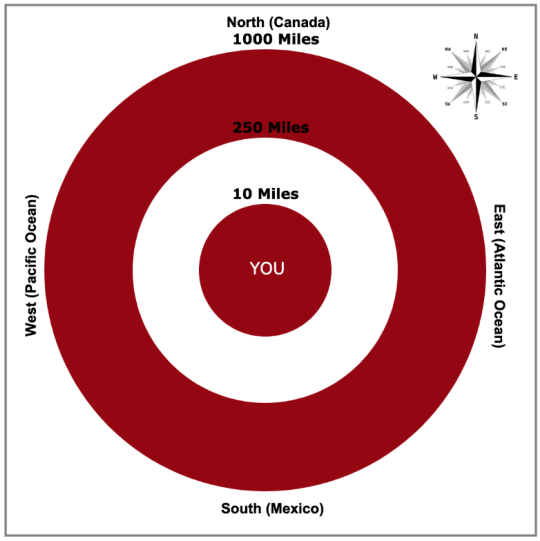
Physical Distance

How far away do you live from each of the five people in your network

YOU live at the center of the map. Drag and drop each person so where they are in diagram represents how far they live from you AND in what Direction (North, South, East, West).

If the person lives with you, place them directly over YOU.

When you are finished click the Proceed button.



BFG

RP

F

M

T

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Appendix B

Patient Health Questionnaire (PHQ-9)-Depression Assessment

PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems? *(Use "✔" to indicate your answer)*	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

FOR OFFICE CODING 0 + _____ + _____ + _____

=Total Score: _____

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	**Somewhat difficult**	**Very difficult**	**Extremely difficult**
☐	☐	☐	☐

Appendix C

Generalized Anxiety Disorder (GAD-7) Scale-Anxiety Assessment

GAD-7 Anxiety

Over the last two weeks, how often have you been bothered by the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid, as if something awful might happen	0	1	2	3

Column totals _____ + _____ + _____ + _____ =

Total score _____

If you checked any problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

Appendix D

The Suicide Behaviors Questionnaire-Revised (SBQ-R)

SBQ-R Suicide Behaviors Questionnaire-Revised

Patient Name _____ Date of Visit _____

Instructions: Please check the number beside the statement or phrase that best applies to you.

1. Have you ever thought about or attempted to kill yourself? (check one only)

- ☐ 1. Never
- ☐ 2. It was just a brief passing thought
- ☐ 3a. I have had a plan at least once to kill myself but did not try to do it
- ☐ 3b. I have had a plan at least once to kill myself and really wanted to die
- ☐ 4a. I have attempted to kill myself, but did not want to die
- ☐ 4b. I have attempted to kill myself, and really hoped to die

2. How often have you thought about killing yourself in the past year? (check one only)

- ☐ 1. Never
- ☐ 2. Rarely (1 time)
- ☐ 3. Sometimes (2 times)
- ☐ 4. Often (3-4 times)
- ☐ 5. Very Often (5 or more times)

3. Have you ever told someone that you were going to commit suicide, or that you might do it? (check one only)

- ☐ 1. No
- ☐ 2a. Yes, at one time, but did not really want to die
- ☐ 2b. Yes, at one time, and really wanted to die
- ☐ 3a. Yes, more than once, but did not want to do it
- ☐ 3b. Yes, more than once, and really wanted to do it

4. How likely is it that you will attempt suicide someday? (check one only)

- ☐ 0. Never
- ☐ 1. No chance at all
- ☐ 2. Rather unlikely
- ☐ 3. Unlikely
- ☐ 4. Likely
- ☐ 5. Rather likely
- ☐ 6. Very likely

Appendix E

Experiences of Close Relationships-Revised- General Short Form (ECR-R-GSF)

		1=Strongly Disagree.....7=Strongly Agree						
1.	I prefer not to show others how I feel deep down	1	2	3	4	5	6	7
2.	I feel comfortable sharing private thoughts and feelings with other people	1	2	3	4	5	6	7
3.	I find it difficult to allow myself to depend on other people	1	2	3	4	5	6	7
4.	I often worry that other people close to me don't really love me	1	2	3	4	5	6	7
5.	I am very comfortable being close to other people	1	2	3	4	5	6	7
6.	I often worry that other people don't care as much about me as I care about them	1	2	3	4	5	6	7
7.	I worry a lot about my relationships	1	2	3	4	5	6	7
8.	When I show my feelings to people I care about, I'm afraid that they will not feel the same about me	1	2	3	4	5	6	7
9.	It is usually easy for me to discuss my problems and concerns with other people	1	2	3	4	5	6	7
10.	My relationships with people make me doubt myself	1	2	3	4	5	6	7
11.	It helps to turn to others for support in times of need	1	2	3	4	5	6	7
12.	I find that other people don't want to be as close as I would like	1	2	3	4	5	6	7
13.	Sometimes people change their feelings about me for no apparent reason	1	2	3	4	5	6	7
14.	I am nervous when people get too emotionally close to me	1	2	3	4	5	6	7
15.	My desire to be close sometimes scares people away	1	2	3	4	5	6	7
16.	I feel comfortable depending on other people	1	2	3	4	5	6	7
17.	I am afraid that once somebody gets to know me, he or she won't like who I am	1	2	3	4	5	6	7
18.	I find it easy to depend on other people	1	2	3	4	5	6	7
19.	It makes me mad that I don't get the affection and support I need from other people	1	2	3	4	5	6	7
20.	It is easy for me to be affectionate with other people	1	2	3	4	5	6	7