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AN EXPLORATION OF THE RELATIONSHIPS AMONG CONNECTEDNESS
TO NATURE, QUALITY OF LIFE, AND MENTAL HEALTH

by

Peter G. Tauber

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Psychology

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Logan, Utah

2012

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ABSTRACT

An Exploration of the Relationships Among Connectedness to Nature,
Quality of Life, and Mental Health

by

Peter G. Tauber, Master of Science

Utah State University, 2012

Major Professor: Gayle S. Morse, Ph.D.
Department: Psychology

The current study examined the relationships among connectedness to nature (CTN), quality of life (QOL), and mental health (MH). Theory in biophilia and ecopsychology has emphasized the importance of the human relationship with the natural world for the health of individuals, our species, and our planet as a whole. Previous research has documented the relationship between experiences in nature and outcomes of health and well-being. However, scant research has examined the correlates of the concept of CTN. Furthermore, no research has examined the relationship between CTN and measures of well-being such as QOL or MH. In the current study, 267 undergraduate students completed a series of self-report items measuring CTN, QOL, MH, and demographic characteristics. Significant relationships between CTN and all categories of dependent variables (QOL, MH, and demographics) were found. In addition, the subcategory of CTN closely related to the desire for direct experiences in nature, NR

experience was shown to have a stronger relationship to QOL and MH than overall CTN—as evidenced by more significant correlations and by serving as a better predictive model through multiple regression. QOL, MH, and demographic variables were collectively found to predict 21% of the variance in overall CTN, while those same variables were found to predict 35% of the variance in NR experience. Implications of these findings based on previous research, limitations of the current study, and future avenues of research are discussed.

(126 pages)

PUBLIC ABSTRACT

An Exploration of the Relationships Among Connectedness to Nature,
Quality of Life, and Mental Health

by

Peter G. Tauber, Master of Science

Utah State University, 2012

In recent decades, a new branch of psychology has emerged—ecopsychology. This field looks at the complex relationship between human beings and the natural world. Previous research has shown the importance of direct experiences in nature for the promotion of human health and well-being. However, it is still not understood why these experiences in nature carry so much importance.

It is possible that the concept of connectedness to nature (CTN) plays a role in this relationship between nature and wellness. CTN is defined as feelings of close affiliation with the natural world in a physical, cognitive, and emotional manner. Previous research leaves open the possibility that these feelings of affiliation and connectedness may contribute to well-being.

To try to better understand this idea, a survey was designed to measure CTN, quality of life, and mental health. Since research of these ideas has never been performed before, this should be considered an exploratory project. In this current study, 267 undergraduates at Utah State University participated.

Results indicated that certain aspects of mental health and quality of life were related to overall CTN. First, relationships were found between mental health and quality of life variables and one specific aspect of CTN which can also be thought of as the desire to have direct experiences in the natural world. Second, demographic factors such as age, gender, and ethnicity were all associated with CTN. Future research should try to understand what things might contribute to CTN and to develop interventions which might increase CTN and well-being.

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Peter G. Tauber

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CHAPTER I

INTRODUCTION

Many consider the beginning of the modern environmental movement to reach back into to the middle of the 20th century with the publication of seminal works like Aldo Leopold's (1949) *A Sand County Almanac* and Rachel Carson's *Silent Spring* (1962), capitulating with a spate of national legislation in the 60s and 70s such as the National Environmental Policy Act (1969), the Clean Air Act (1963), and the Endangered Species Act (1973). Now we are witnessing a second resurgence in environmental interest due to the salience of global climate change and the influence of high-profile environmentalists such as Al Gore and films such as *An Inconvenient Truth* (Bender & Guggenheim, 2006). The contemporary environmental movement has raised awareness of the consequences of our planet-affecting actions on both our species and our planet as a whole.

While the modern environmental movement in the United States is still relatively new, other cultures have always valued the importance of preserving our land and maintaining a balance between the natural and built environment. For example, those who ascribe to traditional Native American beliefs typically do not recognize a separation between their personal identity and the natural world; often both nature and their environment are included in their sense of self. For these people, harm committed against nature and the environment can be considered personal harm (LaDuke, 2005). In this way personal health and psychological well-being are closely tied with the health and well-being of the ecosystem. In contrast to those long-held beliefs of Native cultures,

contemporary Western culture is now just beginning to examine the link between nature and psychological health. This is evident in treatises defining the burgeoning field of ecopsychology (Roszak, Gomes, & Kanner, 1995) and its subfield, ecotherapy (Buzzell & Chalquist, 2009). These compilations emphasize the important role of the human relationship with the natural world for promoting and maintaining psychological health.

Indeed, recent research has begun to examine this human-nature connection. Several measures have recently been created which attempt to quantify the concept of connectedness to nature (Mayer & Frantz, 2004; Nisbet, Zelenski, & Murphy, 2009; Schultz, 2002). For the purpose of this study, *connectedness to nature* can be defined as the extent to which an individual's view of nature is incorporated into their perception of their own sense of self (Schultz, 2002). This broad definition includes physical, cognitive, and emotional elements of that relationship. *Nature* in this sense can be defined as spaces big or small consisting predominantly of flora and fauna and having little or no human constructions (Schultz, 2000). Now that the concept of connectedness to nature has now been defined and rendered quantifiable, emerging research has examined the relationship between this variable and other important indicators of well-being such as psychological health and quality of life (QOL).

Since research indicates that 46.4% of all Americans will suffer from a mental health (MH) disorder at some point in their lives (Kessler et al., 2005), it is crucial to gain more knowledge about the potential connections between MH and other personal characteristics like one's relationship with the natural world. If people are motivated to increase their sense of connectedness to the natural world for personal reasons such as

improvements in their own health and well-being, then they may be more motivated to seek out a more personal affiliation with the natural world. But, to date, no research has examined the links between sentiments of connectedness to the natural world and measures of physical or psychological health. However, emerging research has linked experiences in the natural world with health and well-being. Experiences in nature have been associated with significant personal gains such as an increase in positive affect (Burns, 2008), decreased substance use (Frumkin, 2001), and lower rates of symptoms of mental distress (Chalquist, 2009).

This new and interesting research suggests that it may be possible that one's sentiments of connectedness to nature (CTN) are also related to wellness. In order to explore this, the current research will frame CTN around the broad concept of QOL as well as aspects of MH. To date no one has directly examined the link between beliefs and perceptions of a personal connection to nature and a broad measurement of QOL. Nor has a comprehensive measure of MH been applied to this issue either. The following review of the literature will critique and synthesize the previous research centered on the concept of connectedness to nature and its relationship to health and QOL. In addition, this review will examine what specific aspects of QOL and MH are most related to the human connection with nature, and how they are related.

CHAPTER II

LITERATURE REVIEW

The Literature Review Procedure

Objectives

To understand of the current state of research with regards to connectedness to nature, health, and well-being, this chapter has three objectives: (a) to describe the current state of research regarding exposure and connectedness to nature and their relationships to health and QOL; (b) to discuss the issues, strengths, and weaknesses in previous research regarding the above topics; and (c) to draw conclusions based on this information from which the research questions and strategies for this study were formulated.

Keywords

A preliminary search of the PsycINFO, Academic Search Premier, and Utah State University library databases was conducted to identify all studies published prior to August, 2011, that reported either: (a) measures of connectedness to nature or (b) the effects on health and wellbeing of time spent in the natural world. A variety of search terms and search term combinations were used including: CONNECTEDNESS, CONNECT* TO NATURE, CONNECT* TO ENVIRONMENT, and NATURE AND HEALTH. Additional articles were found through the reference sections of articles identified through the database searches and from review articles on the health effects of time spent in nature (Chalquist, 2009; Frumkin, 2001).

Inclusion/Exclusion Criteria

Articles were included in this literature review if they met one of the following criteria: (a) they contained a measure quantifying a sentiment of connection to the natural world or (b) they documented the relationship between time spent in nature and physical and/or MH. Studies were excluded if either: (a) no measure of connectedness to nature was mentioned or (b) the study did not document the effects of health and well-being for an intervention in the natural world.

**Philosophical and Theoretical Underpinnings of
Connectedness to Nature****Overview**

The goal of this section is to summarize the theory which could be used to explain the importance and significance of the human connection to nature. In an attempt to find contemporary theory which explains the affiliation between humans and the natural world, works from diverse fields such as biology, philosophy, and psychology were examined.

The Biophilia Hypothesis

It is evident that many people value nature highly and are willing to spend significant amounts of time and money in order to interact with it through behaviors such as paying a premium for a good view, devoting time to a garden, or hiking or driving great distances to reach a desired natural setting (Clayton, 2003). The biophilia hypothesis (Kellert & Wilson, 1993; Wilson, 1984) posits that there is an innate

emotional affiliation of human beings to other living organisms. This hypothesis suggests that humans have grown to appreciate and protect other forms of life. Furthermore, the demonstration of respect for all forms of life on this planet may assure our continued survival as a species as the interconnected nature of life on this planet requires the maintenance of a harmonious equilibrium between all forms of life.

This human need to affiliate with other living creatures extends far beyond the mere exploitation of nature's material resources to include the influence of nature on our emotional, cognitive, aesthetic, and even spiritual development (Kellert, 1993). Thus, our inherent Biophilia pervasively influences our thoughts and feelings. Sentiments of affiliation vary on a personal level and some of that variation may be accounted for by factors such as one's level of exposure to nature. Still, it is hypothesized that all human beings possess some degree of biophilia (Kellert & Wilson, 1993; Wilson, 1984). And, by tapping into this trait through empirical investigation, it is possible to gain a greater understanding of the reasons behind humans' inherent connection to the natural world.

Deep Ecology

Viewing ourselves as a part of nature and understanding this human connection to nature has also been explored in the field of deep ecology (Roszak et al., 1995). Deep Ecology approaches the issue from a mainly philosophical and theoretical perspective. It emphasizes the development of theory exploring the interconnectedness of all life forms and the inherent value of all living creatures. However, perhaps due to the inability to operationalize its terms and assess them in an empirical manner, deep ecology lacks empirical support in the literature. Nevertheless, its theoretical propositions, such as the

connectedness of all living creatures and the inherent value of all living beings for nonutilitarian reasons, has strongly influenced both the environmental movement and contemporary theories of human connectedness to the natural world. These in turn have led to more direct, empirical applications of this theory which examine the human relationship with nature through the field of ecopsychology.

Ecopsychology

Ecopsychology concerns itself with more applied and practical aspects of humans' connectedness to nature. Through research and practice, the field of ecopsychology seeks to explore more specific details regarding the human-nature relationship. It places psychological research and the study of wellness in the context of our current ecological systems. This includes experimental research published in peer-reviewed journals such as *Ecopsychology*. For example, a recent issue of this journal covered such diverse areas as outcome data for youth offenders who participate in a wilderness adventure program (Russell, 2010) and the efficacy of applying different social psychological principles to improve conservation behaviors (Meineri, Martin, & Grandjean, 2010). In addition, the ecopsychology movement also targets the general public through the publication of mass-market monographs such as those by Richard Louv (*Last Child in the Woods* and *The Nature Principle*) and Bill McKibben (*The End of Nature* and *Deep Economy*). Ecopsychology has also gained a foothold in the fields of psychotherapy and counseling. In *ecotherapy* (Buzzell & Chalquist, 2009), the authors explored how nature can be applied to a therapeutic context in diverse areas such as equine therapy, couples work, and work with trauma.

Ecopsychological theory emphasizes the importance of expanding our sense of self to include other living beings and the natural environment as a whole in addition to empathizing with other forms of life. This concept of an ecological self as a nature-inclusive identity is synonymous with a belief in the human connection to nature. Including nature in one's self-identity implies a perception of belonging to nature and relating with it intimately. Although there has been a lack of empirical research regarding the specific concept of ecological self, numerous researchers have attempted to quantify the human-nature relationship in other terms with a variety of scales and measures.

Summary of the Theoretical Underpinnings of Connectedness to Nature

Based on the above findings, there is an emerging literature base which informs the theoretical understanding of CTN. Through the work of biologists, philosophers and psychologists, the significance and importance of the human-nature connection has been suggested. A relationship with the natural world is hypothesized to directly affect one's physical, mental, and overall wellness through the benefits gained by increased exposure to nature and positive experiences in the natural world. Sentiments of connectedness to the natural world may also be interpreted as a representation of the intention to be integrated more fully with the other living beings on this planet and in that regard may be related to QOL and wellness. Thus, the goal of the current project is to empirically investigate how sentiments of connectedness to the natural world are related to wellbeing and to gain a better understanding of the significance of the human-nature connection through empirical exploration.

Measures Quantifying the Human-Nature Relationship

Overview

A review of the measures used to examine the human-nature relationship provides an overview of how the above theoretical underpinnings can be placed in an applied, empirical context. The goal of this section is to document previously published measures purporting to describe the human-nature relationship and then engage in a critical analysis of their strengths and weaknesses. The objective of this section is to determine which measures, if any, could be deemed appropriate for the current study involving the construct of CTN.

The New Ecological Paradigm

The concept of the human connection to the natural world described by the biophilia hypothesis and in the ecopsychology movement has been studied empirically using measures that quantify and categorize the human relationship with the natural environment. The first researchers in this area concerned themselves with developing a paper and pencil survey to quantify how one can measure sentiments and attitudes towards nature and the environment. The result of this inquiry was the development of the new environmental paradigm, the first measure designed to tap into personal attitudes and beliefs about nature (Dunlap & VanLiere, 1978). It was later updated to become the new ecological paradigm (NEP; Dunlap, Van Liere, Mertig, & Jones, 2000).

The 15 item NEP is a measurement of people's ecological worldviews and environmental concern. It measures the degree to which a person views humans as an

integral part of the natural environment instead of being seen as separate from nature. It also taps basic, essential beliefs about the nature of the earth and humanity's relationship with it. Representative items include "plants and animals have as much of a right to exist as humans," "the balance of nature is very delicate and easy to upset," and "humans have the right to modify the natural environment to suit their needs." Overall, the measure elicits cognitive beliefs about people's relationship with the natural world. However, the measure lacks items which go beyond cognitions to include a sense of emotional or physical affiliation with the natural world. The measure also lacks items which directly tap into the concept of CTN elucidated in the theoretical literature of biophilia or ecopsychology. Thus, while its cognitively based statements certainly tap into people's beliefs about the human relationship with nature, the measure fails to include physical, emotional, or behaviorally-based manifestations of connectedness to nature relevant to this study.

Environmental Value Orientations Scale

Similar to the highly cognitive NEP, a different measure was created by Stern and Dietz (1994) to examine the origins of people's environmental concern: the Environmental Value Orientations Scale. Using factor analytic techniques they demonstrated that environmental concerns are related to three different value orientations: egoistic, social-altruistic, and biospheric values. Egoistic values describe attention to environmental issues that affect people personally ("I am concerned about environmental problems because of the consequences for: me, my lifestyle, my health, my future"). Social-altruistic values describe environmental action from a place of moral

obligation and attending to environmental issues that have consequences to other human beings (“I am concerned about environmental problems because of the consequences for: people in my community, all people, children, future generations”). Biospheric values describe judging environmental issues on the basis of the cost and benefits to nature and the biosphere as a whole, thus giving the environment itself moral consideration (“I am concerned about environmental problems because of the consequences for: plants, marine life, birds, animals”). These value domains are all measured by separate scales which are independently calculated.

This measure elicits the reasons why people may be concerned about the environment as opposed to simply documenting the extent of their sentiments of concern. In addition, this measure is worded within the context of “concern about environmental problems.” This is understood to activate both the cognitive and emotional facets of environmental concern. However, this scale lacks components which would make it an appropriate measure of connectedness to nature. Concern for nature is different from connectedness to nature; one can feel concerned about another being or system without expressing strong sentiments of connectedness to that being or system. While this scale is unique in its disambiguation of the reasons why people may be concerned about the environment as well as its emotion-oriented language, it is not an appropriate measure for the concept of connectedness to nature in this study.

Environmental Attitudes Scale

Similarly, Thompson and Barton (1994) formulated two distinct attitudes toward the environment in their Environmental Attitudes Scale. In their measure, one subscale

tracks ecocentrism—valuing nature for its own sake and protecting it because of its intrinsic value. The other subscale, Anthropocentrism, is defined by the belief that nature should be valued only for the material and physical benefits that it can provide for humans. Those with strong ecocentric values were more likely to endorse conservation behaviors and belong in environmental organizations. Those with strong Anthropocentric values were more likely to endorse environmental apathy and less likely to engage in pro-environmental behaviors. This measure is inappropriate for use in the current because it examines attitudes and values towards the natural world which are distinct from the concept of connectedness to nature and do not tap an emotional, cognitive, or physical strength of affiliation with the natural world.

Inclusion of Nature in Self Scale

Instead of framing the human relationship with nature around environmental concerns, other researchers have focused on specific qualities of peoples' connection to the natural world and related those to pro-environmental behaviors. The concept of connectedness to nature was first introduced by Schultz, who designed a measure to examine the extent that people viewed themselves as part of the natural environment (Schultz, 2000, 2001). The Inclusion of Nature in Self scale taps beliefs regarding one's feelings of connection to the natural world through a visual metaphor of overlapping circles (see Figure 1). More overlap between the two circles of "me" and "nature" indicates a stronger connection between those two domains. This method of measuring connectedness to nature confers many advantages. Its visual, nonlinguistic nature allows the subject to express their choice in a context free from the construct of language. This

Choose the one pair of circles that best represents your sense of connection to the natural world and circle that set:

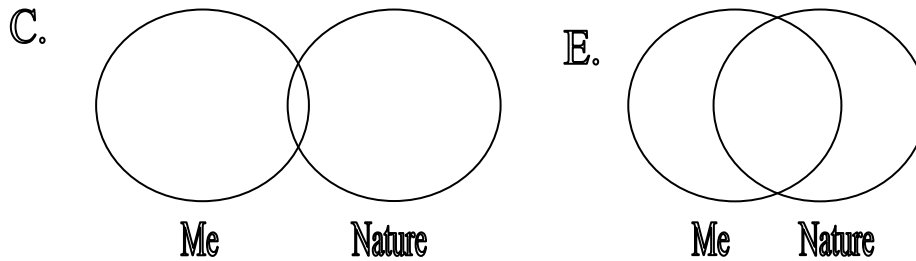


Figure 1. The Inclusion of Nature in Self scale.

could potentially create a less biased and more intuitive measure. In addition, its simplicity and facility of administration make it a very accessible measure to administer. However, it also suffers from a few disadvantages. It offers no details or reasons as to why one may feel that sense of connection. While potentially useful as a single-item measure, it is unclear whether this is a true measure of connectedness to nature or if it could merely be tapping sentiments of affiliation or preference. Furthermore, as a single-item measure, it is impossible to judge internal consistency or reliability. Therefore this measure is not appropriate for use in the current study.

Environmental Identity Scale

Other researchers have been more concerned with issues of identity. Clayton (2003) established a different approach to the topic of the human relationship with the natural environment. She described Environmental Identity through the establishment of a personal sense of connection to the natural environment which is based on history, similarity, and feelings of personal connection (Clayton, 2003). The Environmental

Identity Scale (EIS) combines past and present interactions with nature, self-identification with nature, environmental ideology, and emotional response to nature to create a measure of environmental identity. Environmental identity has been shown to positively correlate with pro-environmental behavior. Thus, someone with a stronger environmental identity would be more likely to endorse efforts of resource conservation and environmental protection. Likewise, those with a weaker environmental identity would be less likely to favor the protection of the environment or the conservation of natural resources. Although the EIS does tap into certain aspects of connectedness to nature such as one's sense of overlap between personal identity and environmental identity, it also draws upon past experiences with nature and political values. Therefore, the EIS broadens the concept of connectedness to the natural world desired for this study by bringing in political beliefs and past experiences in the natural world, and this does not fit the concept of connectedness to nature desired for measurement in this study.

Connectedness to Nature Scale

Another measure designed to quantify the concept of connectedness to nature is the Connectedness to Nature Scale (CNS; Mayer & Frantz, 2004). Based on the theory and writings of Aldo Leopold (Leopold, 1949), the 14-item CNS was designed to measure "an individual's affective, experiential connection to nature" (Mayer & Frantz, 2004). Sample items include, "I often feel a sense of oneness with the natural world around me," "I think of the natural world as a community to which I belong," and "I often feel a kinship with animals and plants" (Mayer & Frantz, 2004). The CNS is an effective measure of environmental attitudes, a multi-item scale, and a good predictor of

environmental behavior. However, the measure also has a few drawbacks. First, there is concern that the CNS does not measure an emotional connectedness to nature as the authors purport, and instead merely taps into cognitive beliefs (Perrin & Benassi, 2009). Also, Perrin and Benassi argued that it is only the scale's self-referential nature and positive tone that account for the differences with the NEP. Furthermore, the measure lacks a physical component of connectedness to nature, which is deemed to be crucial in the construct of connectedness to the natural world (Nisbet et al., 2009). Because of these concerns and the limited definition of "connectedness to nature" proposed by the authors, this measure will not be used as the primary operational definition of CTN in this study.

Nature Relatedness Scale

This study will use a more recent scale to measure the concept of connectedness to nature—the Nature Relatedness (NR) scale (Nisbet et al., 2009). The NR was designed to assess the affective, cognitive, and physical relationships between humans and the natural world. The measure also taps into a sense of appreciation and understanding of the interconnectedness of life on this planet. In addition to functioning as a single, cohesive measure of connectedness, the NR loads onto 3 distinct factors: NR Self, NR Experience, and NR Perspective. See Chapter III for statistics regarding the reliability of this scale, and Table 1 (shown later in Chapter III) for definitions of each subscale and sample items that load onto each individual scale.

Summary and Conclusions

After a review of the measures developed to examine individuals' relationships

with the natural world, the NR (Nisbet et al., 2009) best defines the concept of CTN for purposes of this study. Its multi-scale format allows direct examination of three empirically validated components of connectedness to nature (Schultz, 2002): a personal, self-concept-related aspect, a view of our species' place in the broader ecosystem, and the value of physical experiences in the natural world. This is especially useful when wishing to compare the NR to other measures of health and wellness, as desired in the current study. The NR is sensitive to change after experiences in nature, and the measure was found to be associated with pro-environmental behaviors.

Since the NR has been found to be associated with a few measures of well-being, it is possible that it may be associated with related constructs as well. The following section will examine QOL based on previous literature, provide theoretical background supporting this concept, and describe various measures used to quantify the construct of QOL with the ultimate goal of choosing a measure which best fits the construct of QOL and is most practical for use in the current study.

Quality of Life

Overview of the Construct

“Quality of Life” is a construct created to measure a level of overall well-being in individuals or populations (World Health Organization [WHO], 1997). This broad, far-reaching concept encompasses numerous domains such as one's environment, community, social and family relations, physical health, MH, and leisure activities. Its exact definition varied from one author to the next. One Danish team (Ventegodt et al.,

2005) described QOL with regards to the relationship between one's current life experiences, personal history, and early life biological factors. In this context, QOL contains numerous subjective factors (e.g. meaning in life, life satisfaction, and happiness) and objective factors (e.g. income, status, and work). Health and ability play a large role in determining one's QOL as well. The authors conclude that for many QOL is determined not solely by life events but also by the way that one views and processes those events. This implies a large subjective component to QOL and suggests that QOL is also related to one's ability to be a part of the present reality.

Other authors view QOL as a complement to measures of functional status and health (WHOQOL Group, 1998). According to the WHO, an ideal measure of QOL should include physical, psychological, social, and spiritual domains. These authors assert that QOL is a multidimensional construct which loses a great deal of richness and validity when examined from a mono-dimensional perspective.

Others assert that QOL should be viewed by examining measurable, objective characteristics such as functional status, health, and well-being (Garratt, Ruta, Abdalla, Buckingham, & Russell, 1993). This has led to the creation of many health-related measures of QOL. These measures examine QOL through one's ability to interact with the world and function in basic tasks of living on a day to day basis. These measures also are frequently used to determine how illnesses affect one's ability to function.

Since an investigation into the construct of QOL is relevant and necessary, one way to further explicate definitions of QOL is to examine the measures themselves. For this study, numerous measures of QOL were evaluated with the goal of choosing a

measure that adequately captures the multi-faceted nature of well-being in an appropriate, culturally sensitive manner for a representative sample of healthy, college-aged adults.

The Short Form- 36

First, the category of health-related QOL measures was evaluated to see if one of those measures adequately expressed the above-stated criterion. The Short Form-36 (SF-36) was examined due to its ubiquity (Turner-Bowker, Bartley, & Ware, 2002), popularity, and balance between brevity and comprehensiveness (Ware & Sherbourne, 1992). The SF-36 consists of 36 questions that break down into eight subscales: physical functioning, role limitations due to physical problems, bodily pain, MH, and role limitations due to emotional problems, social functioning, vitality, and general health perceptions.

This measure was not chosen for inclusion in the current study because it provided too limiting and strict of a definition of QOL by focusing mainly on one's capacity to accomplish tasks and function autonomously. While aspects of social functioning and overall well-being are included, their weight with regards to the entire measure is light. While the SF-36 would be quite appropriate in a medical setting, for a healthy, college-age sample there remains the possibility of a limited range of scores and a larger than necessary emphasis on physical health to the neglect of other valuable aspects of well-being.

The Quality of Life Questionnaire

The Quality of Life Questionnaire (Evans & Cope, 1989) was subsequently

examined as a possible measure due to its more broad and inclusive definition of QOL beyond a health related context. In this measure, 192 true/false self-report items were designed to gauge an individual's behavior in the context of their environment. It includes five major domains: general well-being, interpersonal relations, organizational activity, occupational activity, and leisure and recreational activity.

This measure succeeds in creating a broad, multifaceted definition of QOL. It extends beyond merely health related aspects of QOL to include other domains such as work, leisure, and civic responsibilities. However, this operational definition of QOL is not ideal for use in the current study. It appears to be targeted strictly towards working adults of North American culture. It asserts that certain domains like occupation, voting, and charity work are relevant factors for one's QOL. While this may be the case for some, for the college students and young adults (many of whom do not work and are not civically active) who are the subject of the current study, this measure may give an inaccurate impression of QOL by placing value on certain domains which are not as relevant to this cohort. In addition, its definition of QOL appears limited to mainstream North American culture, limiting its generalizability.

The WHOQOL-BREF

The WHO's Quality of Life-Brief measure (WHOQOL-BREF) is a promising measure of QOL for the current study (WHO, 2011). This 26-item measure was designed to allow the participant to determine the importance of certain activities and values in the determination of their own QOL, and so the measure claims to be free of cultural bias and thus applicable worldwide (WHO, 1993). The WHO defined QOL as "individuals'

perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” (WHO, 1997). Consequently, this measure includes physical, mental, social, environmental, and personal belief components of well-being. By focusing on individuals’ perceptions of their own well-being, the measure strives to assess overall functioning in the context of health and QOL (WHO, 1993). For these reasons, the WHOQOL-BREF was chosen as the best measure of QOL for the purposes of this study.

Quality of Life and Connectedness to Nature

The following section will examine several specific aspects of QOL and how they may be related to the construct of CTN. The following review will cover the environmental, social, and physical aspects of QOL. The well-established relationship between MH, an important aspect of QOL included in most measures, and CTN will be reviewed in a forthcoming section.

Environment and Connectedness to Nature

Many experts consider the physical and built environment to compose a significant aspect of QOL (Evans & Cope, 1989; Turner-Bowker et al., 2002; WHO, 1997). The physical characteristics of where one lives and specific aspects of their community such as safety and ease of transportation are aspects of QOL frequently cited in measures (WHO, 1997). These elements of one’s built and natural environment could be related to and influence one’s sentiments of CTN.

Most of the literature which relates sentiments of CTN to the physical

environment examines the differences between rural and urban populations. Rural inhabitants report stronger sentiments of connectedness to the natural world than urban residents (Klassen, 2010; Muller, Kals, & Pansa, 2009). However, these studies measured connectedness to nature as a single item self-report question, making the measure susceptible to problems of internal validity as well as differences in interpretation between participants. Also, those studies were also limited by the lack of socioeconomic diversity in their participants. Another study of rural inhabitants also demonstrated that they reported stronger sentiments of connection with the natural world than urban residents and also reported higher scores on indices of well-being than those from urban areas (Hinds & Sparks, 2009). However, that study similarly suffered from a small sample size and a geographically and ethnically narrow population, reducing its external validity.

This study attempted to expand the connection between an environmental aspect of QOL and CTN by examining how other factors of the built environment besides merely rural living, such as safety or ease of transportation, may be related to CTN.

Social Relationships and Connectedness to Nature

Research connecting social relationships, an important element of QOL, and CTN is currently quite scant. One study (Marcus, Omoto, & Winter, 2011) cited the importance of a sentiment of community and strong interpersonal relationships in the development of the values of environmentalism and participation in environmental issues. The current study intends to collect exploratory data to further examine the

connection between social relationships and sentiments regarding CTN.

Physical Health and Connectedness to Nature

Numerous studies have linked exposure to nature with increased physical health, an important aspect of QOL. One study examined a representative sample of US adults and found higher rates of physical health and well-being in those who have more direct contact with the natural world (Kaplan & Kaplan, 1989). Other lines of inquiry have also linked exposure to nature with positive benefits for physical health in samples of both healthy US adults and those with physical and mental illness (Chalquist, 2009; Frumkin, 2001). Interestingly, sometimes simply having a view of nature has an effect on health. One study found that prison inmates with views of the outdoors area beyond the prison are sick less than those with views of an interior courtyard (Moore, 1981), while another found that patients with views of nature from hospitals rooms recover faster than those with views of a wall (Ulrich, 1984). These studies are notable in their significant efforts to decrease confounding variables and examine only the difference in view. While this health effect could be attributed to qualities of the view besides the mere presence or absence of natural stimuli, these results still deserve attention.

Contact with animals, such as pets, has also been shown to decrease the amount of health problems that their owners may experience. In one prospective study, a community sample of adults was found to experience fewer illness and minor injuries than a comparison group of nonpet owners over a 10-month period (Serpell, 1991). Pet ownership has also been found to be associated with higher levels of physical health

(Mullersdorf, Granstrom, Sahlqvist, & Tillgren, 2010). Unfortunately, it was not determined whether the health-affirming aspects of pet ownership effects were due simply to the presence of a pet in the home or factors associated with pet ownership such as time spent outside or an increase in physical activity or exercise. Thus, one can only speculate as to the mechanism at work in decreasing health problems among pet owners. In addition, hospital administrators have long understood that the presence of plants and gardens increases rates of healing among their patients, and participation in wilderness programs often results in improvements in physical health (Frumkin, 2001). Again, the literature fails to explain how these situations increase healing. It may not be the presence of nature or natural features themselves, but rather elements associated with nature instead. Improvements in health could be accounted for by the increased sensory stimulation and activity levels that gardens provide, and the health-promoting aspect of wilderness programs could be due solely to increased exercise or a decrease in environmental contaminants. Still, these findings merit further investigation.

It should likewise be noted that the exact mechanisms of how time spent in nature may mediate physical health and wellness are unknown. Exposure to nature is often associated with physical exercise, and it is possible that the effects of increased physical activity which happen to take place outdoors account for health improvements.

Alternatively, the effect could even be biological: exposure to a type of bacteria, *M. vaccae*, which is only found outdoors in soil, was shown to produce increases in immune system production and boost levels of serotonin (Lowry et al., 2007). More research is needed to determine the mechanism of action which connects exposure to nature and

physical health.

While physical health is merely one component of QOL, an in-depth examination of the relationship between physical health and exposure to nature reveals the diversity of ways in which exposure to the natural world could be related to one's QOL. In addition, these studies highlight avenues rich for future research which could serve to better explain the mediating factors between exposure to the natural world and personal health.

Mental Health and Connectedness to Nature

Overview

The following section will outline the connections between nature and one's MH. It will begin with an examination of the research connecting experiences in the natural world with changes in MH. After this connection has been established, a review of the small but significant literature supporting the relationship between connectedness to nature and MH will be conducted.

Exposure to Nature and Mental Health

An established base of research catalogs the positive effects of exposure to nature for one's MH. Nature may have a rejuvenating effect: spending time in nature could serve to increase tolerance of stressful situations, improves concentration, and increase productivity (Nisbet & Zelenski, 2011; Nisbet, Zelenski, & Murphy, 2010). Another study examining university students in the United States using cross-sectional survey data reported that those who self-report more contact with the natural world as measured by time spent in a natural environment report higher levels of effective functioning and

personal development, peacefulness as measured by the Positive and Negative Affect Scale, and lower levels of stress as measured by the Perceived Stress Scale (Herzog & Strevey, 2008).

A number of studies have also examined the MH and well-being of inhabitants of rural communities. These populations, which may typically have a higher degree of contact with nature in their daily lives than those from urban areas, may be considered a proxy for those with more exposure to nature. After controlling for a number of factors such as SES, employment, and household income, one investigation demonstrated that rural inhabitants reported lower rates of symptoms of depression and anxiety on the General Health Questionnaire than participants living in urban areas (Weich, Twigg, & Lewis, 2006). Yet, this difference, while statistically significant, demonstrated little practical significance (1/2 point on the General Health Questionnaire).

To date, the exact mechanisms behind the connection between rural life, CTN, and well-being remains unclear. While some hypothesize that rural inhabitants possess a stronger sense of place (i.e. they feel more connected and comfortable with the land on which they live) than urban inhabitants that contributes to increased well-being (Weich et al., 2006), other authors purport that rural living increases one's exposure to the natural world, and nature's subsequent restorative effects cause the increases in well-being (Hinds & Sparks, 2009). Or, it could be that factors inherent to rural life such as less crime, pollution, and crowding could attribute to improvements in well-being. Unfortunately, no peer-reviewed study has pursued this possibility. Regardless, since some models actively attempting to explain mediating factors only account for half of the

variance in the rural inhabitation-well-being connection (Hinds & Sparks, 2009), there is still clearly a great deal more research necessary before anything more than tentative conclusions can be reached regarding the connection between rural life, connectedness to nature, and well-being.

The connection between exposure to nature and MH is also supported by the literature as evidenced by two thorough literature reviews (Chalquist, 2009; Frumkin, 2001). People connected with nature through the ownership of pets such as dogs have shown significant benefits for MH including stress reduction (Siegel, 1990) and decreases in depression (Siegel, Angulo, Detels, Wesch, & Mullen, 1999). Unfortunately, one can only speculate as to the mechanism of action in these studies. It may be due to the fact that dogs, as members of the animal kingdom, increase one's feelings of connectedness to nature in general, which then leads to improvements in MH. Or, as mentioned above, it could simply be that pet ownership necessitates healthy changes in lifestyle such as more time spent outdoors doing physical activity. Or, the added companionship of pets may be providing a boost to mood.

In addition, those who connect with the natural world through gardening and the care of plants benefit from numerous positive MH outcomes according to research in the field of horticultural therapy (Jarrott & Gigliotti, 2010; Rice, Remy, Whittlesey, Simson, & Straus, 1998). Again, it is not entirely understood why this is the case. It could have something to do with the physical act of gardening or perhaps some of its associated features such as caring for other living creatures, interacting with nature, and being outdoors.

Furthermore, ecotherapists in independent practice have reported the mental and physical benefits of contact with nature for their clients (Burns, 2008). For example, one intervention for couples in conflict involved creating shared experiences in natural settings in order to strengthen their relationship. In another situation, reconnecting with special natural areas that were important to one as a child helped to solidify values and improve sentiments of well-being. While this evidence from psychotherapists is anecdotal and requires systematic study to ascertain more definite conclusions, it does indicate an area ripe for future research.

There have even been significant findings detailing nature's restorative effect on emotions. A "natural" stimulus, ocean waves, was specifically selected by the authors of one study to elicit contentment. It was found that the ocean wave sound significantly reduced the cardiovascular stress and sympathetic nervous system arousal elicited by a fearful stimulus (Fredrickson & Levenson, 1998; Fredrickson, Mancuso, Branigan, & Tugade, 2000). However, it may not be ocean waves' nature-related quality that induces the effects of contentment. It could be the repetitive, monotonous nature of the sound that classifies it as contentment-inducing. This study only demonstrates that the stimulus chosen by the authors to be prototypically contentment-inducing happens to be nature related, and that the calming effect was supported by the results. Multiple additional studies have also demonstrated the stress-reducing (Laumann, Garling, & Stormark, 2001; Rader, 2009), restorative effects (Herzog, Black, Fountaine, & Knotts, 1997; Herzog, Maguire, & Nebel, 2003), well-being enhancement (Kaplan, 2001), and mood-improving aspects (Rader, 2009) of exposure to nature and nature-related stimuli. Again,

with all of these studies, it is not possible to determine what specific aspects of these natural stimuli account for increases in well-being. However, the preponderance of results connecting natural stimuli with improvements in health and well-being points to the necessity of further investigation of how this occurs. This study attempted to build on these findings to examine whether this relationship is mediated by sentiments of connectedness to the natural world.

Greenway (1995) demonstrated that participants in a nature-based course were successful at breaking old unhealthy habits such as the consumption of alcohol and tobacco. However, a lack of control variables limits the extent of determining nature's role in the reduction of substance use. Likewise, adolescent participants in wilderness therapy programs, which emphasize the therapeutic aspects of a wilderness setting (Russell, 2003, 2005), have also shown a great deal of positive outcomes such as a stronger desire to reduce maladaptive behavior, less substance abuse, and a better awareness of one's feelings (Russell & Phillips-Miller, 2002). Again, it is difficult to determine the exact role that the natural setting and connectedness to nature play in the process of reaching these positive outcomes.

In addition, a number of thinkers in the field of ecopsychology emphasize the importance of a connection with the earth and its implications for MH (Bragg, 1996; Conn, 1998; Feral, 1998). According to this perspective, a significant amount of mental illness stems from a lack of connection with the natural world in today's modern society. By ignoring and failing to acknowledge our connection to the natural world we are denying a fundamental part of our identity as human beings (Howard, 1997; Roszak et

al., 1995). It is argued that psychological issues such as depression and anxiety can be related back to this sense of disconnect with our natural world and additional concern over the health and well-being of our planet (Buzzell & Chalquist, 2009). Unfortunately, these claims lie solely on theoretical grounds without empirical support. The current explored these theoretical claims.

One commonality does exist among of all of the above findings: there can be only speculation as to the mechanism of action connecting exposure to nature with increases in well-being. These studies are valuable because they provide potential reasons why nature is important for one's personal well-being. However, none of them provide more than corollary evidence connecting direct exposure to natural environments or nature-related stimuli to gains in personal health and well-being. Thus, these findings should be viewed as an indication to further investigate the connection between nature and health and not as support for the health-affirming aspects of exposure to nature. Connectedness to nature could be one of the mediators in the relationship between exposure to nature and health. The following section will examine this possibility.

Connectedness to Nature and Mental Health

Recent research in experimental psychology has served to quantify fundamental Ecopsychological principles by associating measures of connectedness to nature with specific outcomes and implications for health and well-being (Mayer & Frantz, 2004; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009; Nisbet et al., 2010). Research applying the Connectedness to Nature Scale demonstrates a correlation between higher ratings of connection to the natural world and greater life satisfaction (Mayer & Frantz,

2004). However, life satisfaction was only a single item likert-scale question. Thus, the information that can be gleaned from this metric is certainly limited and requires a more detailed examination. In another study sampling U.S. university students, time spent in nature was also found to support reflection of life problems and was associated with higher state levels of connectedness to the natural world (Mayer et al., 2009). After taking a walk in a natural area, students reported that they were more effective in resolving a minor life problem through contemplation than those who performed the same procedure in a non-natural area (i.e., a parking lot). It appears that there is something inherently restorative about time spent in nature. And, this restorative process may be mediated through a greater feeling of connectedness to the natural world in that moment.

Research with the Nature Relatedness (NR) scale has explored the relationship between connectedness with the natural world and well-being (Nisbet et al., 2009). Recent studies have revealed that NR correlates positively with many indicators of well-being including positive affect, autonomy, personal growth, purpose in life, and vitality (Nisbet et al., 2010). A more recent investigation using this scale has shown that an increased positive affect can result from taking a walk in a natural area compared to taking the same walk indoors. Furthermore, both positive affect and time in a natural area contribute to higher levels of Nature Relatedness (Nisbet & Zelenski, 2011). It seems from this finding that NR mediates the relationship between time spent in nature and positive affect. However, further research is required to support the results of this single study.

Summary and Conclusions

As evident above, research supports the relationship between experiences in the natural world and positive MH outcomes. Additionally, a small but growing body of work has found relationships between the novel concept of CTN and indicators of MH. Further research should attempt to build on these initial findings regarding CTN in order to better understand the importance of the human-nature connection.

Mental Health

Overview

Mental illness represents a significant problem in this country with 26.2% of all adults receiving a DSM-IV diagnosis and \$57.5 billion spent on MHcare during a one year period (Kessler et al., 2005). Many factors have been found to influence one's MH status. Differences in age and sex are found in many mental illnesses such as major depressive disorder (American Psychiatric Association [APA], 2000; Waraich, Goldner, Somers, & Hsu, 2004) and panic disorder (Eaton, Kessler, Wittchen, & Magee, 1994; Goodwin et al., 2005). Socioeconomic status (SES) may also influence MH in areas such as eating disorders (Palma-Coca et al., 2011) and depression (Kosidou et al., 2011). Ethnic differences have also been found in the prevalence of many mental disorders such as substance use disorders (Bray, Adams, Getz, & Baer, 2001; Huang et al., 2006). Since spirituality has also shown to be an important factor in the treatment of substance use disorders (Franklin, Markarian, Frances, Miller, & Mack, 2005; Lyons, Deane, Caputi, & Kelly, 2011), information regarding strength of spiritual beliefs is deemed important. In

addition, exercise has been found to play a role in the prevalence (Strohle, 2009) and treatment of various mental disorders such as depression (Mota-Pereira et al., 2011) and anxiety (Carek, Laibstain, & Care, 2011). Interestingly, many studies have found pet ownership to be associated with lower levels of MH as well (Mullersdorf et al., 2010; Parslow, Jorm, Christensen, Rodgers, & Jacomb, 2005).

Quality of Life and Mental Health

Research has firmly established the relationship between QOL and MH. A thorough review of this body of literature is beyond the scope of the current study. However, a brief mention of a few studies incorporating similar measures to the current study merits attention. One study found moderate to strong positive correlations between QOL as measured by the WHOQOL and MH as measured by the SCL-90 in a group of Dutch psychiatric outpatients (Trompenaars, Masthoff, Heck, Hodiament, & Vries, 2005). Another study found similar findings in a group of alcoholic males (Barros da Silva Lima, Fleck, Pechansky, de Boni, & Sukop, 2005). Additionally, a third study also found a strong positive relationship between MH and QOL in adults with mood disorders (Trompenaars, Masthoff, Van Heck, Hodiament, & De Vries, 2006). These findings are understandable due to the fact that most measures of QOL, such as the WHOQOL, include an assessment of MH as a fundamental aspect of QOL. Thus, this relationship between QOL and MH will not be a focus of the current study due to the extensive body of previous work in this area and the already well-established relationships.

Concluding Remarks

Previous psychological research has certainly demonstrated the feasibility of developing a measure which accurately quantifies the sentiment of connectedness to nature discussed through the biophilia hypothesis (Wilson, 1984) and writings of ecopsychologists (Buzzell & Chalquist, 2009; Roszak et al., 1995). Numerous other studies have also demonstrated the strong link between exposure to nature and measures of physical and MH. In addition, researchers are now just beginning to move in the direction of directly applying measures of connectedness to nature to the categories of health and wellness. However, while recent research has touched upon some of the potential benefits of possessing strong sentiments of connectedness to nature such as increased positive affect and greater life satisfaction, no studies have examined the explicit connection between sentiments of connectedness to nature and specific indicators of health and QOL. Therefore, the following specific aims and research questions were proposed.

Specific Aims and Research Questions

This study addressed four specific aims: (1) to explore the relationship between CTN and demographic variables (age, class standing, major, GPA, sex, ethnicity, SES, location of childhood home, strength of spiritual beliefs, pet ownership, amount of exercise); (2) to explore the relationship between CTN and QOL, (3) to explore the relationship between CTN and MH; and (4) to explore what other factors relate to CTN, and to what extent.

This study addressed the following research questions related to Aim 1.

1. How were the responses for demographic variables and CTN (1 overall scale and 3 subscales) distributed across the sample?
2. What were the relationships between CTN and the demographic variables suggested by previous research?

This study addressed the following research questions related to Aim 2.

1. How were the responses for QOL (1 general rating and 4 subscales) distributed across the sample?
2. What were the relationships between CTN and QOL scales?

This study addressed the following research questions related to Aim 3:

1. How were the responses for MH (1 overall scale and 9 subscales) distributed across the sample?
2. What were the relationships between CTN and MH scales?

This study addressed the following research question related to Aim 4:

1. Which of the above variables (demographics, global QOL, and global MH) most strongly predicted CTN, and to what extent?

The research questions may contribute meaningfully to the research base because they help to clarify connections between holding sentiments of connectedness to the natural world and indicators of personal well-being. If these hypotheses are supported, an argument could be made to investigate possible causal relationships between variables. This could lead to interventions designed to increase CTN, which in turn may contribute to increases in MH and QOL, resulting in healthier and better functioning people.

CHAPTER III

METHODS

Setting and Sample

Data collection took place in Logan, UT, a small college town of approximately 48,000 people in the Cache Valley region of Northern Utah. Participants were recruited via class presentations and an online recruitment system, Sona Systems (www.sona-systems.com), from a pool of psychology students at Utah State University during the spring semester of 2012. In the Sona System the students had the opportunity to participate in this study by selecting it from a list of approved experiments conducted by the university as one possible way to obtain course credit. Their decision to choose participation in this experiment was based on only its title (“Connectedness to Nature and Wellness”) and the time commitment required (approximately 30 minutes). In order to promote a wider diversity of students, participants were also recruited from sections of Introductory English. During their class time, students participated in the survey and listened to the researcher give a lecture of the research process as part of a course objective of learning about research methodology.

An undergraduate college sample was chosen for many reasons. First, the Nature Relatedness scale was partially validated on this population (Nisbet et al., 2009) so it is hoped that the normality of distribution, subscale validity, and correlations will all also apply to this college population as well. Although utilizing this population may limit external validity and generalizability, previous research has shown enough variance in

this population's levels of CTN (Nisbet & Zelenski, 2011; Nisbet et al., 2009), MH (Eisenberg, Hunt, Speer, & Zivin, 2011), and QOL (Liu et al., 2009; Wang, Kao, Huan, & Wu, 2011) to be useful for this study.

Measures

Demographics

Because of the differences in age and sex in many mental illnesses such as major depressive disorder (APA, 2000; Waraich et al., 2004) and panic disorder (Eaton et al., 1994; Goodwin et al., 2005), it was important to examine these demographics in this study. SES may also influence MH (APA, 2000), and thus required inclusion in the current study. Ethnic differences have been found in the prevalence of many mental disorders, such as substance use disorders (Bray et al., 2001; Huang et al., 2006), so this information was collected because of its importance for MH.

In addition to these basic demographics of age, sex, ethnicity, and SES, several other demographic characteristics were assessed (see Appendix A). These included the strength of spiritual beliefs and the location of one's childhood home (urban vs. suburban vs. rural). Because aspects of spirituality are consistent with sentiments of connectedness to the natural world (Buzzell & Chalquist, 2009; Roszak et al., 1995) as well as substance use (Franklin et al., 2005), information regarding strength of spiritual beliefs was deemed important. And, stemming from differences in sentiments of CTN related to geographic factors such as a rural location (Hinds & Sparks, 2009; Muller et al., 2009), information regarding one's geographic location appeared valuable as well. Because exercise, both

outdoors and in general, may influence MH (Chalquist, 2009; Frumkin, 2001), frequency data regarding those activities was collected. Finally, since it has been suggested that dog ownership and pet ownership in general may influence health and well-being (Serpell, 1991), questions assessing involvement in those two areas were collected as well. The collection of these demographics helped to provide more information regarding the characteristics of those with high and low levels of CTN and may even serve to inform ways to predict sentiments of connectedness to the natural world in the future.

The Nature Relatedness Scale (NR)

As previously discussed, the NR measure taps into three components of the human-nature connection: emotions, cognitions, and a physical relationship to the natural world (see Appendix B). In general, it encompasses an appreciation and understanding of the interconnectedness of life (Nisbet et al., 2009). The NR loads onto three distinct factors: NR self (Chronbach's $\alpha = 0.84$), NR perspective (Chronbach's $\alpha = 0.66$), and NR experience (Chronbach's $\alpha = 0.80$). See Table 1 for definitions and examples of items on these scales.

The NR shows solid internal consistency (Chronbach's $\alpha = 0.87$), and is temporally stable (test-retest $r = 0.85$). Its internal validity is supported by correlations between Overall NR and environmentally responsible behavior (belonging to an environmental organization and buying organic, fair trade products; $r = 0.53$) as well as professing a love of animals ($r = 0.34$; Nisbet et al., 2009).

Although this measure lacks some external validity due to its testing with a population of college students and one adult community sample (Nisbet et al., 2009,

Table 1

Examples of Items from Each Subscale of the NR Scale

Variable	NR-self	NR-perspective	NR-experience
Definition	One's view of nature as a part of their self	An external, nature-related worldview	The desire to be out in nature experiencing it directly
Example 1	I feel very connected to all living things on earth.	Humans have the right to use natural resources any way that we want.	My ideal vacation spot would be a remote, wilderness area.
Example 2	My connection to nature and the environment is an important part of my spirituality.	I think a lot about the suffering of animals.	The thought of being deep in the woods, away from civilization, is frightening.

2010; Nisbet & Zelenski, 2011), its high overall reliability combined with its ability to tap into the three distinct domains of the cognitive, physical and emotional aspects of connectedness to nature make it an appropriate measure for the purposes of this study.

World Health Organization Quality of Life measure (WHOQOL-BREF)

The WHO Quality of Life (WHOQOL) measure (see Appendix C) was created to develop a measure of QOL that is applicable across cultures (WHO, 2011). This allowed participants from different cultures to dictate the most salient aspects of QOL for them (WHO, 1993). The WHO defined QOL as “individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” (WHO, 1997). This broad ranging concept supports the WHO's conception of health as a state that is beyond the presence or absence of disease. Their concept also includes physical, mental, social, environmental, and personal belief components of well-being. By focusing on

individuals' perceptions of their own well-being, the measure strives to assess overall functioning in the context of health and QOL (WHO, 1993).

The WHOQOL-BREF, an abbreviated 26 item measure, was simultaneously designed with the WHOQOL to be more convenient for use in research studies involving other measures (WHO, 2011). While much shorter than the 100 item original measure, the WHOQOL-BREF still manages to remain comprehensive, comprising at least one question from each of the 24 facets relating to QOL as well as 2 items which assess overall QOL and health. Additionally, the measure was found to be highly correlated with the longer WHOQOL ($0.89 < r < 0.95$; WHO, 1993), and possess comparable discriminate validity.

The WHOQOL-BREF consists of four domains: physical, psychological, social relationships, and environment. All questions are scored on a 5-point Likert scale, with the labels varying depending on the wording of the question. Examples of questions from each domain are found in Table 2.

Table 2

Examples of Items from Each Subscale of the WHOQOL-BREF

Variable	Physical	Psychological	Social relationships	Environment
Definition	Examining physical health and wellbeing	Examining mental health and psychological wellbeing	Examining personal relationships with other people	Characteristics of the community in which you live
Example 1	To what extent do you feel that physical pain prevents you from doing what you need to do?	How well are you able to concentrate?	How satisfied are you with your personal relationships?	How satisfied are you with your access to health services?
Example 2	Do you have enough energy for everyday life?	How often do you have negative feelings such as blue mood, despair, anxiety, and depression?	How satisfied are you with the support you get from your friends?	How safe do you feel in your daily life?

Multiple regression analysis shows that each of the four domains contributes significantly to Overall QOL. In addition, the WHOQOL-BREF measure shows good internal consistency: values for each subscale ranged from $\alpha = 0.71$ to $\alpha = 0.86$ (WHO, 1993). It shows good to excellent psychometric properties of reliability: correlations range from $r = 0.68$ to $r = 0.95$ depending on the question. Discriminant validity was determined by comparing well and ill populations using t tests, and differences across all domains were found to be significant ($p < .001$; WHO, 1998). It was also shown to be discriminately valid from another measure of QOL, the SF-36 (Turner-Bowker et al., 2002) and its shorter version, the SF-12 (von Steinbachel, Lischetzke, Gurny, & Eid, 2006), with t tests demonstrating $p < .001$ between the WHOQOL-BREF and SF-36/SF-12. Those measures tend to relate more information regarding health status and health services utilization, while the WHOQOL-BREF relates more strongly with overall QOL outside of a healthcare construct (Huang, Wu, & Frangakis, 2006). This further supports the WHOQOL-BREF's appropriateness for use in this proposed study.

Symptom Checklist-90-Revised (SCL-90-R)

The Symptom Checklist-90-Revised (SCL-90-R) is a paper-and pencil psychological assessment tool used to evaluate a broad range of psychological problems and symptoms of psychopathology (Derogatis, 2011). It is used by both MH professionals and researchers, making it an appropriate measure for the purposes of this study.

This self-report measure examines the participant's subjective experience. The

measure consists of 90 self-report items measuring psychological symptom patterns which have occurred during a current, point-in-time period of the past 7 days (Derogatis, 1994). The test's use of a 5-point Likert scale of the subject's experience of distress (0 = not at all, 2 = moderately, 4 = extremely), along with a sixth-grade reading level, make this test easily accessible for a wide range of participants.

The test comprises nine primary symptom dimensions or subscales (somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism) and three global indices of distress (global severity index, positive symptom distress index, and positive symptom total), which serve to provide a better overall assessment of the participant's MH. The Global Severity Index is considered the most sensitive numeric indicator of respondent's psychological status (Derogatis, 1994). Thus, only that global index will be assessed in the current study.

The test has demonstrated strong internal consistency ($0.79 < \alpha < 0.90$; Horowitz, Rosenberg, Baer, Ureno, & Villasenor, 1988) in addition to strong convergent and discriminate validity (Derogatis, 1994). More than 1,000 studies have been conducted which demonstrate the reliability, validity, and utility of this instrument (Derogatis, 2011). And, while it is difficult to determine test-retest reliability due to the varying nature of psychological symptoms, especially throughout the course of treatment, the measure has been shown to be relatively stable in non-treatment conditions (Derogatis, 1994).

The measure has also been shown to be sensitive to psychological distress, detecting differences across the complete spectrum from mild to severe distress.

However, like most measures consisting of subjective ratings with Likert scales, the scoring is totally subjective (one participant's "3" rating may mean something different than another participant's "3" rating). Therefore, it is important to compare scores to a norm group in order to gain the best understanding of the results (Derogatis, 1994). While anonymity may serve to reduce the effect of social desirability in these self-report measures, it is acknowledged that social desirability may still be an issue and a limitation of any self-report measure.

Procedure

Approval to conduct this research was obtained by the Utah State University Institutional Review Board. Prior to the start of the study, participants were presented with a letter of information ensuring informed consent that detailed the purpose, procedure, risks, and benefits of participation in the study (Appendix A). Participants completed a series of paper-based self-report measures: demographic information (Appendix B), the NR (Appendix C), the WHOQOL-BREF (Appendix D), and the SCL-90-R. All measures were completed in a group setting in a classroom or research office at Utah State University.

CHAPTER IV

RESULTS

The first section of the results will attempt to answer the research questions related to Aim 1: (a) how the responses for demographic variables and CTN (one overall scale and three subscales) are distributed across the sample and (b) a description of the relationships between CTN and the demographic variables. This will be accomplished through the use of descriptive statistics, correlations, *t* tests, and ANOVA.

The second section of the results will attempt to answer the research questions related to Aim 2: (a) how the responses for QOL (one general rating and four subscales) are distributed across the sample and (b) a description of the relationships between CTN and QOL scales. This will be accomplished through the use of descriptive statistics and correlations.

The third section of the results will attempt to answer the research questions related to Aim 3: (a) how the responses for MH (one overall scale and nine subscales) are distributed across the sample and (b) a description of the relationships between CTN and MH scales. This was accomplished through the use of descriptive statistics and correlations.

The fourth section of the results will attempt to answer the research question related to Aim 4: which of the above variables (demographics, global MH, and global QOL) predict CTN, and to what extent. This will be accomplished through multiple regression analysis.

Descriptive Statistics

Two hundred sixty-seven students were included for participation in the current study. Females accounted for 49.81% of the cohort. Ages ranged from 18-49, with a mean age of 21.41 years ($SD = 4.89$). 88.01% of the sample identified as being in their first two years of college. Regarding ethnicity, 80.83% of the population identified as White. See Table 3 for a complete description of the sample characteristics.

Aim 1: Connectedness to Nature and Demographics

Demographic variables and CTN variables were first cleaned and sorted in preparation for analysis. Appropriate items were reverse scored (items 2, 3, 10, 11, 13, 14, 15, 18), and scale scores were computed. All appropriate items were examined for linearity and normality using box plots, histograms, and an examination of skewness and kurtosis. The variables met the assumptions of linearity and normality necessary for later regression analysis. See Appendix E for histograms describing the mean, standard deviation, and distribution of scores for all NR scales.

Table 4 displays descriptive statistics of the sample for the nature relatedness subscales and overall score for current study sample and the normative sample from which the measure was designed (Nisbet et al., 2009). The t tests revealed statistically significant differences between the two samples ($p < .05$) for all scales: NR self ($t = 4.11$), NR perspective ($t = 2.08$), NR experience ($t = 4.35$), and overall NR ($t = 3.09$). However, a calculation of effect size between the two samples reveals small standard mean differences between the two samples ranging from 0.20 to 0.40. The current

Table 3

Demographic Characteristics of the Sample (N = 267)

Characteristic	Means or proportion, %	SD
Sex		
Female	49.81	
Male	50.19	
Age (range: 18-49)	21.41	4.89
Ethnicity		
White	80.83	
Asian/Asian American	2.63	
Black/African American	1.13	
Hispanic	6.77	
Multiethnic	7.14	
Other	1.50	
Location of childhood home		
Urban	25.76	
Suburban	57.20	
Rural	17.04	
Household income		
\$15k or less	42.15	
\$15k-\$25k	14.88	
\$25k-\$45k	11.57	
\$45k-\$65k	8.68	
\$65k-\$100k	11.57	
\$100k+	11.15	
Importance of spirituality (1= low, 5 = very high)		
1	9.43	
2	7.17	
3	9.82	
4	23.01	
5	50.57	
How often do you exercise in nature? (1= never, 5 = very often)		
1	4.53	
2	19.24	
3	31.32	
4	27.93	
5	16.98	
Are you a pet owner?		
Yes	56.16	
No	43.94	

Table 4

Descriptive Statistics for Nature Relatedness Scales

Nature relatedness scale	Current study sample (<i>N</i> = 267)		Normative sample (<i>N</i> = 183)		<i>ES</i>
	Mean	<i>SD</i>	Mean	<i>SD</i>	
NR self	3.35	0.79	3.04	0.78	0.40
NR perspective	3.39	0.66	3.52	0.64	-0.20
NR experience	3.67	0.79	3.33	0.85	0.40
NR overall	3.46	0.57	3.29	0.58	0.29

sample's scores for NR are comparable enough to the normative sample to allow for interpretation.

Bivariate correlations using Pearson's *r* were run between CTN (as measured by the NR scale and its 3 subscales) and demographic variables. See Table 5 for all correlations. Visual inspection of correlations by scatter plots indicated linear relationships for all scales examined.

Age was positively correlated with Nature Relatedness for overall NR ($r = .25, p < .01$), NR perspective ($r = .18, p < .01$), and NR self ($r = .28, p < .01$) but not NR Experience ($r = .12, n.s.$). Sex also showed a positive correlation with overall NR ($r = .17, p < .01$), NR self ($r = .15, p < .05$), and NR perspective ($r = .30, p < .01$), with women demonstrating higher scores, but not NR Experience ($r = -.05, n.s.$). No relationship was found between household income and NR or strength of spiritual beliefs and NR at the overall or subscale level. A positive correlation was found between GPA and overall NR ($r = .14, p < .05$) as well as between GPA and the NR self ($r = .16, p < .05$). Exercise outdoors was found to have a positive correlation with overall NR ($r = .22,$

Table 5

Correlations Between Connectedness to Nature and Demographic Variables

Demographic variable	Outcome variables			
	NR experience	NR self	NR perspective	NR overall
Age	.12	.28**	.18**	.25**
Sex ^a	-.05	.15*	.30**	.17**
Household income	-.03	-.01	-.03	-.03
Strength of spiritual beliefs	.10	.11	-.08	.06
GPA	.12	.16*	.01	.14*
Amount of exercise outdoors	.34**	.04	.46**	.22**
Pet ownership	.06	.09	.14*	.12

^a 0 = male; 1 = female.

* $p < .05$.

** $p < .01$.

$p < .01$), NR perspective ($r = .46, p < .01$), and NR experience ($r = .34, p < .01$), but no statistically significant correlation with the NR Self ($r = .04, n.s.$). Pet ownership was found to have a positive correlation with NR perspective ($r = .14, p < .05$) but not NR self ($r = .09, n.s.$), NR experience ($r = .06, n.s.$), or overall NR ($r = .12, n.s.$).

In order to better understand the properties of the NR scale in comparison to previous research (Nisbet et al., 2009) correlations between NR scales were also determined. Overall NR was found to be statistically significantly correlated with the NR experience ($r = .74, p < .01$), NR self ($r = .88, p < .01$) and NR perspective subscales ($r = .65, p < .01$). The NR Experience subscale was found to be correlated with the NR self subscale ($r = .51, p < .01$) but not the NR perspective subscale ($r = .74, n.s.$). The NR self subscale was found to be correlated with the NR Perspective subscale ($r = .48, p < .01$).

These findings are similar to the outcomes of previous research (Nisbet et al., 2009).

In addition to the above correlations, the relationship between the location of one's childhood home and CTN as well as Ethnicity and CTN were also examined. A series of between subjects one-way ANOVAs were performed to determine the relationship between location of childhood home (urban, suburban, or rural) and the various aspects of NR. There was a significant effect for location of childhood home on NR Experience, $F(2,261) = 5.95, p < .01$. Post-hoc comparisons using the Scheffe test indicated that the mean score for the rural condition ($M = 3.92, SD = 0.66$) was statistically significant and different than the mean scores for the suburban ($M = 3.62, SD = 0.78, p = .03$) and urban ($M = 3.43, SD = 0.94, p < .01$) conditions. There was no significant effect for location of childhood home for overall NR, $F(2,257) = 1.71, n.s.$, NR perspective, $F(2,258) = 0.29, n.s.$; or NR self, $F(2,260) = 1.12, n.s.$ Those who grew up in a rural location reported stronger ratings of NR Experience than those who grew up in urban or suburban settings.

The relationship between Ethnicity and CTN was also determined. Due to the lack of large sample sizes for many ethnic identities, the variable of Ethnicity was collapsed and recoded into two categories—White and non-White. This allows for the comparison of CTN and ethnicity through a series of independent samples t tests. For NR experience there was a significant difference found between White ($M = 3.76, SD = 0.74$) and non-White ($M = 3.28, SD = 0.89$) students, $t(264) = 3.97, p < .01$. It appears that White students endorse stronger ratings of NR Experience than non-White students. No significant differences between White and non-White students were found for NR self,

$t(263) = 0.03$, n.s.; NR perspective, $t(261) = -1.73$, n.s.; or overall NR, $t(260) = 1.04$, n.s.

Aim 2: Connectedness to Nature and Quality of Life

QOL variables were first cleaned and sorted in preparation for analysis. Scale scores were then computed. All appropriate items were examined for linearity and normality using box plots, histograms, and an examination of skewness and kurtosis. Data met the conditions for linearity and normality. See Appendix F for histograms describing the distribution of scores with means and standard deviations for all WHOQOL scales.

Next, descriptive statistics were examined for all subscales of the WHOQOL-BREF (Table 6). These scores were compared to a normative group consisting of a general community population (Hawthorne, Herman, & Murphy, 2006). Scores were reported on a scale of 1-100 as recommended by the authors to ensure parsimony with previous research. The t tests revealed significant differences ($p < .05$) between the two samples for physical QOL ($t = 7.99$) and social relationships QOL ($t = 2.03$). However, a

Table 6

Descriptive Statistics of WHOQOL-BREF Compared to a Normative Sample

WHOQOL-BREF subscale	Current study sample		Normative sample		<i>ES</i>
	Mean (<i>N</i> = 267)	<i>SD</i>	Mean (<i>N</i> = 866)	<i>SD</i>	
Physical QOL	81.00	11.30	73.50	18.10	0.41
Psychological QOL	69.00	11.50	70.60	14.00	-0.11
Social relationships QOL	69.00	15.60	71.50	18.20	-0.14
Environment QOL	75.00	10.40	75.10	13.00	0.01

calculation of effect size between the two samples reveals small standard mean differences between the two samples ranging from 0.01 to 0.41. The current sample's scores for QOL are comparable enough to the normative sample to allow for interpretation.

Bivariate correlations using Pearson's r were run between CTN (as measured by the NR scale) and QOL variables (as measured by the WHOQOL-BREF). See Table 7 for all correlations. Visual inspection of correlations by scatter plots indicated linear relationships for all scales examined. Positive correlations were found between NR experience and several aspects of QOL: general QOL ($r = .15, p < .05$), physical QOL ($r = .18, p < .01$), and psychological QOL ($r = .20, p < .01$). No other correlations between NR Experience and QOL variables were significant. No statistically significant correlations were found between NR Self and QOL variables or between the NR perspective and QOL variables. A small positive correlation was found between overall

Table 7

Correlations Between Connectedness to Nature and Quality of Life Variables

QOL variable	Outcome variables			
	NR experience	NR self	NR perspective	NR overall
General rating of QOL	.15*	.06	.03	.11
Health satisfaction	-.08	-.01	-.05	.01
QOL physical	.18**	.02	-.03	.07
QOL psychological	.20**	.10	-.01	.14*
QOL social relationships	.10	.06	.07	.10
QOL environment	.11	.01	-.07	.02

* $p < .05$.

** $p < .01$.

NR and psychological QOL ($r = .14, p < .05$). No other correlations between overall NR and QOL variables were significant.

In order to better understand the properties of the WHOQOL-BREF in comparison to use with a normative population, correlations between all QOL subscales were also examined. Physical QOL was found to be significantly correlated with the psychological QOL ($r = .58, p < .01$), social relationships QOL ($r = .42, p < .01$), and environment QOL ($r = .61, p < .01$). Psychological QOL was found to be significantly correlated with the social relationships QOL ($r = .58, p < .01$) and environment QOL ($r = .55, p < .01$). Social relationships QOL was found to be significantly correlated with environment QOL ($r = .49, p < .01$). Current findings are similar to previous results for this measure (WHO, 2011).

Aim 3: Connectedness to Nature and Mental Health

MH variables were first cleaned and sorted in preparation for analysis. Appropriate items were recoded and scale scores were computed. All scales were examined for linearity and normality using box plots, histograms, and an examination of skewness and kurtosis. Data met the conditions for linearity and normality. Please see Appendix G for histograms describing the distribution of scores for all MH scales.

Next, descriptive statistics were examined for all subscales and the global severity index of the SCL-90-R. These scores were compared to a normative group consisting of a non-patient community sample from which the measure was developed (Derogatis, 1994). See Table 8 for a complete description of both samples. Effect size in the form of

Table 8

Descriptive Statistics of the SCL-90 Compared to a Normative Sample

SCL-90 Scale	Current study sample (<i>N</i> = 267)		Normative sample (<i>N</i> = 974)		<i>ES</i>
	Mean	<i>SD</i>	Mean	<i>SD</i>	
Somatization	0.32	0.29	0.36	0.42	-0.10
Obsessive-compulsive	0.53	0.37	0.39	0.45	0.31
Interpersonal sensitivity	0.42	0.35	0.29	0.39	0.33
Depression	0.45	0.35	0.36	0.44	0.20
Anxiety	0.24	0.29	0.30	0.37	-0.16
Hostility	0.27	0.27	0.30	0.40	-0.08
Phobic anxiety	0.10	0.18	0.13	0.31	-0.10
Paranoid ideation	0.33	0.33	0.34	0.44	-0.02
Psychoticism	0.25	0.28	0.14	0.25	0.44
Global severity index	0.33	0.25	0.31	0.31	0.06

the standardized mean difference was calculated comparing the current study sample to the normative sample for all subscales and the global severity index. Effect sizes were small, with values ranging from 0.02 to 0.44. The current sample's scores for MH are comparable enough to the normative sample to allow for interpretation.

Bivariate correlations using Pearson's *r* were run between CTN (as measured by the NR Scale and its three subscales) and MH variables (as measured by the SCL-90-R). See Table 9 for all correlations. Visual inspection of correlations by scatter plots indicated linear relationships for all scales examined. Some negative correlations were found between NR experience and interpersonal sensitivity ($r = -.15, p < .05$), depression ($r = -.14, p < .05$), hostility ($r = -.18, p < .01$), and phobic anxiety ($r = -.12, p < .01$). No other correlations between NR experience and MH variables were significant. No significant correlations were found between NR self and MH variables. A positive

Table 9

Correlations Between Connectedness to Nature and Mental Health Variables

MH variable	Outcome variables			
	NR experience	NR self	NR perspective	NR overall
Somatization	.02	.11	.13*	.12
Obsessive-compulsive	-.08	.06	.06	.02
Interpersonal sensitivity	-.15*	.03	.06	-.03
Depression	-.14*	.01	.09	-.03
Anxiety	-.03	.11	.10	.08
Hostility	-.18**	-.11	-.01	-.13*
Phobic anxiety	-.12**	.06	.08	.01
Paranoid ideation	-.10	.06	.06	.01
Psychoticism	-.08	.04	.05	.01
Global severity index (overall)	-.09	.08	.10	.04

* $p < .05$.** $p < .01$.

correlation was found between NR perspective and somatization ($r = .13, p < .05$), but no other correlations between NR perspective and MH variables were significant. A negative correlation was found between overall NR and hostility ($r = -.18, p < .05$). No other correlations between overall NR and MH variables were found to be significant.

Aim 4: Multiple Regression

First, zero-order correlations were calculated among all variables to be included as predictors for subsequent regressions: demographic characteristics, the QOL scales, and MH scales. These were analyzed to determine the potential influence of multicollinearity. See Table 10 for a complete description of all correlations.

Table 10
Correlations Among All Study Variables

Variables ^a	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1.00																			
2	-.55	1.00																		
3	.04	-.11	1.00																	
4	-.12*	-.01	.16*	1.00																
5	.02	-.05	.17*	-.04	1.00															
6	-.11	-.18**	-.01	-.10	.08	1.00														
7	-.17**	-.12	-.01	-.13*	-.04	.46**	1.00													
8	-.05	-.09	-.04	-.03	.02	.59**	.58**	1.00												
9	.11	-.09	-.05	-.06	.04	.53**	.42**	.58**	1.00											
10	-.12	-.23**	-.04	-.10	.20**	.47**	.61**	.55**	.49**	1.00										
11	.14*	.02	-.07	-.04	.02	-.24**	-.51**	-.40**	-.15*	-.35**	1.00									
12	.24**	.08	.01	.07	-.12	-.37**	-.46**	-.57**	-.41**	-.40**	.52**	1.00								
13	.10	.02	.11	-.03	-.01	-.32**	-.45**	-.55**	-.44**	-.37**	.42**	.68**	1.00							
14	.15*	-.10	.04	.02	-.10	-.49**	-.54**	-.71**	-.46**	-.48**	.56**	.78**	.76**	1.00						
15	.14*	.01	.01	.02	-.01	-.35**	-.53**	-.57**	-.25**	-.42**	.71**	.62**	.76**	.76**	1.00					
16	.13*	.06	.01	.06	-.10	-.27**	-.41**	-.34**	-.31**	-.29**	.48**	.50**	.48**	.54**	.52**	1.00				
17	-.01	.02	.06	.09	-.05	-.18**	-.39**	-.35**	-.23**	-.37**	.44**	.46**	.59**	.51**	.62**	.42**	1.00			
18	.15*	-.07	.13*	.03	-.01	-.34**	-.43**	-.42**	-.43**	-.42**	.49**	.60**	.70**	.63**	.57**	.52**	.45**	1.00		
19	.04	.04	.08	.06	-.03	-.34**	-.41**	-.49**	-.41**	-.32**	.47**	.64**	.71**	.76**	.64**	.54**	.51**	.66**	1.00	
20	-.01	-.04	.05	.01	-.07	-.42**	-.58**	-.64**	-.40**	-.48**	.73**	.85**	.84**	.91**	.87**	.65**	.65**	.77**	.83**	1.00

^a 1. Sex. 2. Age. 3. Location of Childhood Home. 4. Ethnicity. 5. SES. 6. General Rating of QOL. 7. Physical QOL. 8. Psychological QOL. 9. Social QOL. 10. Environment QOL. 11. GSI. 12. Somatization. 13. Obsessive-Compulsive. 14. Interpersonal Sensitivity. 15. Depression. 16. Anxiety. 17. Hostility. 18. Phobic Anxiety. 19. Paranoid Ideation. 20. Psychoticism.

For sex, male = 0, female = 1

For location of childhood home rural=0, nonrural=1;

For ethnicity 0 = White, 1 = non-White

* $p < .05$, ** $p < .01$.

Due to strong correlations between predictor variables there were initial concerns of multicollinearity in this sample. All MH variables were significantly correlated with all QOL variables at moderate to high levels. In addition, sex was associated with several aspects of MH, QOL, and demographics. Furthermore, location of childhood home was correlated with ethnicity and SES, while environment QOL was correlated with SES and age. Given the already-established correlation between MH and QOL (Barros da Silva Lima et al., 2005; Trompenaars et al., 2005, 2006), these correlations were expected. The potential for multicollinearity in this sample will be assessed through regression analysis.

To determine the variance in CTN explained by the predictor variables in addition to examining the extent of the multicollinearity between the QOL and MH variables, a single entry multiple regression analysis was performed which included the QOL scales, the GSI, and demographic variables. Due to the high correlations between MH subscales, it was hoped that using the GSI instead of MH subscales would give a clearer picture of the potential multicollinearity between MH and QOL while also giving a calculation of the variance in CTN explained by the predictors. Ethnicity was dichotomized to white/nonwhite based on the characteristics of the sample, and location of childhood home was dichotomized to rural/nonrural based on the results of a previous ANOVAs. With 167 participants analyzed for this regression, it was determined that adequate power existed to account for the 10 predictor variables in the regression equation.

The model was found to meet all assumptions for performing regression. The model was shown to have a significant fit for the data overall, $R = 0.39$; $F(10, 166) = 4.13$, $p < .01$. Table 11 displays the results of the multiple regression analysis predicting

Table 11

Multiple Regression: Predicting Overall Nature Relatedness with Demographic Variables, QOL Variables, and GSI

Variable	Coefficients ^a					Colinearity statistics	
	Unstandardized coefficients		Standardized coefficients		Tolerance	VIF	
	β	SE	β	p value			
(constant)	1.25	0.65		.06			
Sex ^b	0.17	0.09	0.15	.05	.90	1.12	
Age	0.03	0.01	0.29	.01	.91	1.11	
Location of childhood home ^c	-0.02	0.10	-0.02	.82	.94	1.07	
Ethnicity ^d	-0.06	0.11	-0.04	.55	.92	1.08	
SES	0.01	0.01	0.02	.84	.88	1.13	
QOL physical	0.10	0.11	0.09	.36	.51	1.96	
QOL psychological	0.31	0.10	0.35	.01	.39	2.56	
QOL social relationships	-0.03	0.06	-0.05	.60	.63	1.56	
QOL environment	-0.03	0.11	-0.02	.79	.53	1.90	
GSI	0.01	0.01	0.24	.01	.53	1.90	

^a $F= 4.13$, $R= 0.39$, $R^2 = 0.15$, $p < 0.01$.

^b male = 0, female = 1.

^c rural = 0, nonrural = 1.

^d White = 0, non-White = 1.

overall NR. The model with all 10 predictor variables accounts for approximately 15% of the variance in nature relatedness for the sample ($R^2 = .15$). However, the model only accounts for 11% of the variance of the population (adjusted $R^2 = .11$).

Previous research (Myers, 1990) indicated that predictor variables with a tolerance statistic of less than 0.10 should be considered a significant risk for multicollinearity. Similarly, predictor variables with a VIF statistic of 10 or greater also indicate a strong risk for multicollinearity. For the current regression, tolerance levels

ranged from .39 to .94, with VIF statistics ranging from 1.07 to 2.56. Therefore, multicollinearity was not deemed a concern for this particular regression and it is possible to interpret the contributions of predictor variables.

Sex ($t = 2.01, p = .05$), age ($t = 3.95, p = .01$), psychological QOL ($t = 3.08, p = .01$), and the GSI ($t = 2.48, p = .01$) all had had significant beta weights. No other predictor variables demonstrated statistical significance.

To determine the contribution of all aspects of QOL and MH in the prediction of CTN, a single entry multiple regression analysis was run with demographic (see Table 12), QOL subscales, and MH subscales as predictors. SES, Ethnicity, Social QOL, and Environment QOL were removed as predictors due to their lack of correlation with CTN variables, lack of previous literature demonstrating any relationship between these variables and CTN, and very low beta weights in the previous regression. With 196 participants analyzed, it was determined that adequate power existed to account for the 14 predictor variables in the regression equation.

Again, the predictors were examined in light of their colinearity using the standard of a tolerance level less than .10 and a VIF greater than 10 to indicate significant multicollinearity in a predictor variable (Myers, 1990). For the current regression analysis, tolerance levels ranged from .17 to .94 and VIF statistics ranged from 1.06 to 6.05. Therefore, multicollinearity was not deemed a concern for this regression equation.

Age ($t = 4.24, p < .01$), sex ($t = 2.62, p = .01$), psychological QOL ($t = 3.17, p < .01$), anxiety ($t = 2.00, p = .05$), and Hostility ($t = -1.95, p = .05$) had significant beta weights for regression. No other predictor variables demonstrated statistical significance.

Table 12

Multiple Regression: Predicting Overall Nature Relatedness with Demographic, QOL, and Mental Health Variables

Variable	Coefficients ^a				Collinearity statistics	
	Unstandardized coefficients		Standardized coefficients		Tolerance	VIF
	β	<i>SE</i>	β	<i>p</i> value		
(constant)	1.58	0.55		.01		
Sex ^b	0.21	0.08	0.18	.01	.82	1.22
Age	0.03	0.01	0.28	.01	.91	1.10
Location of childhood home ^c	-0.09	0.09	-0.07	.33	.94	1.06
QOL physical	0.01	0.10	0.01	.97	.50	2.01
QOL psychological	0.28	0.09	0.33	.01	.38	2.67
Somatization	0.01	0.01	0.02	.87	.40	2.50
Obsessive-compulsive	0.01	0.01	0.13	.25	.31	3.18
Interpersonal sensitivity	0.01	0.01	0.07	.58	.27	3.74
Depression	-0.01	0.01	-0.14	.37	.17	6.05
Anxiety	0.03	0.01	0.26	.05	.24	4.20
Hostility	-0.03	0.02	-0.16	.05	.60	1.67
Phobic anxiety	-0.03	0.02	-0.13	.15	.47	2.13
Paranoid ideation	0.01	0.02	0.02	.82	.42	2.38
Psychoticism	0.02	0.01	.16	.16	.30	3.30

^a $F= 3.77$, $R= 0.46$, $R^2= 0.21$, $p < 0.01$.

^b male = 0, female = 1.

^c rural = 0, nonrural = 1.

Based on previous significant correlations between the NR Experience scale and measures of MH and QOL, another model was created to determine the ability of variables to predict NR Experience. Variables were chosen based on previous research linking experiences in nature with MH, QOL, and demographic variables as well as previous significant relationships found in this study. The GSI was chosen instead of the 9 MH subscales due to concerns about possessing adequate power to perform the

regression. With 209 participants analyzed, it was determined that adequate power existed to account for the 8 predictor variables in the regression equation.

Using a tolerance level of less than .10 and VIF statistics greater than 10 to represent significant multicollinearity (Myers, 1990), the predictors were examined in light of their collinearity. For the current regression, tolerance levels ranged from .47 to .97 and VIF statistics ranged from 1.04 to 2.13. Therefore, despite correlations between many predictor variables, multicollinearity was not deemed a concern for this regression equation.

The model was found to meet all assumptions for performing regression. The model was shown to have a significant fit for the data overall, $R = 0.59$; $F(8, 208) = 13.35$, $p < .01$. Table 13 displays the results of the multiple regression analysis predicting NR Experience. The model with all 8 predictor variables accounted for approximately 35% of the variance in nature relatedness for the sample ($R^2 = .35$). However, the model only accounted for 32% of the variance of the population (adjusted $R^2 = .32$). Age ($t = 2.15$, $p = .03$), Sex ($t = -2.15$, $p = .03$), Ethnicity ($t = -3.21$, $p = .01$), Location of Childhood Home ($t = -1.98$, $p = .05$), and Amount of Exercise Outdoors ($t = 7.62$, $p = .01$) had significant beta weights for regression. Psychological QOL approached significance ($t = 1.91$, $p = .06$). No other predictor variables demonstrated statistical significance.

Table 13

Multiple Regression: Predicting NR Experience with Demographic, QOL, and Mental Health Variables

Variable	Coefficients ^a				Colinearity statistics	
	Unstandardized coefficients		Standardized coefficients		Tolerance	VIF
	β	SE	β	<i>p</i> value		
(constant)	2.39	0.69		.01		
Age	0.02	0.01	0.13	.03	.97	1.04
Sex ^b	-0.21	0.10	-0.13	.03	.92	1.09
Ethnicity	-0.38	0.12	-0.19	.01	.92	1.09
Location of childhood home ^c	-0.22	0.11	-0.12	.05	.96	1.04
Exercise outdoors	0.33	0.04	0.46	.01	.90	1.11
QOL physical	-0.03	0.12	-0.02	.81	.55	1.83
QOL psychological	0.20	0.10	0.16	.06	.47	2.13
GSI	0.01	0.01	0.07	.42	.50	2.00

^a $F= 13.35$, $R= 0.59$, $R^2 = 0.35$, $p < 0.01$

^b male = 0, female = 1

^c rural = 0, nonrural = 1

CHAPTER V

DISCUSSION

The present study aimed to determine the relationship between CTN as measured by Nature Relatedness and three other areas: demographic characteristics of the sample (Aim 1), QOL (Aim 2), and MH (Aim 3). In addition, the contribution of various predictors to CTN, including aspects of QOL, MH and demographics, was investigated (Aim 4). Drawing on the theoretical framework of biophilia (Kellert & Wilson, 1993; Wilson, 1984) and ecopsychology (Buzzell & Chalquist, 2009; Roszak et al., 1995) as well as previous work examining the construct of CTN (Mayer & Frantz, 2004; Nisbet et al., 2009), it was predicted that QOL and MH would positively correlate with CTN and that aspects of QOL, MH, and demographics would all contribute significantly to the variance of CTN.

These hypotheses were all supported. CTN was found to be positively correlated with numerous demographics including age, sex, GPA, pet ownership, and amount of outdoor exercise. Regarding QOL, physical and psychological QOL were both found to be correlated with aspects of CTN. CTN was also found to be associated with some aspects of MH such as hostility, depression, and phobic anxiety. Additionally, demographic, QOL, and MH variables were found to predict around one fifth of the variance in overall CTN. Age, sex, psychological QOL, anxiety, and hostility were found to be significant predictors in this model.

Knowledge of these relationships may be helpful in predicting factors related to overall health and wellness. In addition, this knowledge may be used to promote future

positive health behaviors. These possibilities, a further examination of the results, as well as limitations and potential implications of these findings will be discussed in more detail in the following sections.

Demographics

The sample was evenly distributed by sex. In terms of age, the sample was young, with 92% reporting an age under 30. This limited range may account for CTN's low correlations with age. While the majority of the population identified as being from a suburban environment, those from urban and rural areas were also well represented. This statistic is consistent with the population distribution of the geographic area from which the students are drawn. It should also be noted that the strong ratings of spirituality endorsed this sample of college students may limit generalizability.

Implications for Past Theory and Research

The theory and research of ecopsychology (Buzzell & Chalquist, 2009; Roszak et al., 1995) suggested that our health and wellness as human beings is in some way related to the health of the natural world and our ecosystem. It also stated that sentiments of CTN are associated with positive outcomes in health and well-being. The current study attempted to test this hypothesis of the linkage between sentiments of connectedness to nature and outcomes of health, well-being, and QOL. The following sections will examine the findings of the connection between CTN and well-being as broken down by each specific hypothesis and also relate those findings to previous research in the field.

CTN and Demographics

It should be noted that the current sample (Table 4) reported significantly higher mean scores for all three subscales and the overall scale when compared to the population on which the norms for this measure were established (Nisbet et al., 2009). Perhaps this is due to a social desirability effect and an understanding of the underlying hypotheses of the study. Or it is possible that they expressed higher scores due to unique characteristics of this sample such as abundant access to the outdoors and proximity to rural areas. However, while differences between samples were statistically significant, the effect sizes were small, indicating that the two samples' qualities were comparable. Therefore, it appears appropriate to apply findings derived from the normative sample for use in the current sample.

Older individuals displayed higher ratings of nature relatedness and age contributed significantly to the prediction of both overall CTN and NR experience. These are novel findings not noted in previous studies of CTN that use the Nature Relatedness Scale (Nisbet et al., 2009, 2010) or Connectedness to Nature Scale (Mayer & Frantz, 2004; Mayer et al., 2009). Because of the restricted age range of the sample (78% are 18-22, 92% are under 30, and 99% are under 40), these findings should not be applied to middle-aged or older adults.

Women were also found to endorse stronger ratings of CTN than men, and sex was shown to be a significant predictor of both overall CTN and NR experience. Again, this is a novel study not previously noted in the literature and could be associated with gender instead of biological sex. Previous studies examining the new ecological

paradigm, a more cognitive measure of environmental beliefs, did report that women displayed more positive attitude towards the environment than men (Mayer & Frantz, 2004; Zelezny, Chua, & Aldrich, 2000). Thus, findings regarding a sex difference in measures relating to the natural world appear to be mixed. Since the sex difference in the current study was even more pronounced when examining the NR Perspective scale than the overall scale, this may suggest that women are more capable of understanding the world from a non-human point of view. It is possible that women are more inclined towards taking the perspective of animals, plants, and living beings besides humans. This would be consistent with previous research noting gender differences for sympathetic and empathetic responses towards people (Berg, Majdan, Berg, Veloski, & Hojat, 2011; Lee, Gibbons, & Short, 2010) and animals (Angantyr, Eklund, & Hansen, 2011).

The finding that pet owners reported higher ratings of NR Perspective is consistent with previous research (Nisbet et al., 2009). As this scale measures one's sense of humanity's place in the broader ecosystem, it is not surprising that those who own pets are also more aware of the place of human beings in a larger natural context. However, this effect is very small, and of limited practical significance.

The relationship between exercise outdoors and NR as evidenced by both correlations and through exercise outdoor's significant prediction of NR Experience suggests that more desire for contact with the natural world is associated with stronger sentiments of CTN. This conclusion is particularly relevant to the place of humanity in the global ecosystem and one's desire for direct experiences in the natural world. This finding is consistent with previous research demonstrating that more time spent in the

natural world is closely affiliated with sentiments of affinity towards the natural environment (Kals, Schumacher, & Montada, 1999; Raudsepp, 2005). In addition, these findings are consistent with the work of Kellert (2002), who indicated that direct contact with nature through experiences such as time spent outdoors plays a significant role in determining sentiments of CTN. This finding also serves to increase the construct validity of the NR scale; it is expected that those who report spending more time outdoors would also feel more connected to natural areas.

Similarly, the finding that rural individuals endorse stronger sentiments of NR Experience is consistent with previous research (Klassen, 2010; Muller, Kals et al., 2009). It is suggested that this may be due in large part to an increased level of exposure to nature due to geography and lifestyle which is inherent in rural life. Or, it could be that rural inhabitants place a higher value on nature for economic reasons. Further exploration of the relationship between rural location and CTN would be useful.

Additionally, the results of the current study suggest that White individuals demonstrate higher levels of one aspect of CTN, NR Experience, than non-White individuals. Ethnicity was also shown to be a significant predictor of NR Experience. This suggests that the non-White members of the sample are less inclined to value direct experiences in the natural world as measured by the NR scale. This finding has not been reported in previous research using the NR scale (Nisbet et al., 2009, 2010) or Connectedness to Nature Scale (Mayer & Frantz, 2004; Mayer et al., 2009). One possibility for this novel finding is that cultural differences between ethnicities may account for a different valuation of experiences in the natural world. This would be

consistent with previous research linking differences in outdoor recreation preferences by ethnicity (Carr & Williams, 1993; Walker, Deng, & Dieser, 2001). It is possible that further exploration with a more diverse sample will reveal interesting features of the relationship between CTN and ethnicity.

Based on the results of this sample, it appears that White individuals and women report higher ratings of CTN. These are novel findings not appearing in previous research. Older individuals may also endorse stronger sentiments of CTN, but the sample's small range limits the value of this finding. Supporting previous research, those who exercise more outdoors and those from a rural background also endorse higher ratings of CTN. Finally, no relationship between SES and spirituality was found in these exploratory domains.

CTN and QOL

Ratings of QOL are in general similar between this sample and a normative community sample (Hawthorne et al., 2006). However, it should be noted that the current sample reported significantly higher ratings of physical and social QOL than the normative sample. Since this is a young sample, it is generally expected that they are likely to have fewer physical health problems than a sample from the general population. Also, the social and collegial nature of the undergraduate experience could explain higher ratings on social QOL. However, it should be noted that effect sizes for differences between groups for all subscales were small. Therefore, it is reasonable to state that this population, despite being slightly more physically healthy and social, is comparable to

the general population.

It appears that, for this sample, QOL has few direct relationships to Connectedness to Nature. Based on these results, one's sentiments about their built environment and community as measured by environment QOL appear to be unrelated to CTN. Previous literature has not examined this specific construct and its relationship to CTN (Mayer & Frantz, 2004; Nisbet et al., 2009). However, research involving participants from rural areas demonstrated that rural inhabitants reported stronger sentiments of CTN than others (Klassen, 2010; Muller et al., 2009). Given that this rural/nonrural difference was also found in the current study, it is likely that the Environment QOL scale does not tap into the same domains which would distinguish rural and nonrural participants. Previous research has also found that natural aspects of one's environment, such as plants and gardens, also influence QOL (Frumkin, 2001). Again, questions from the WHOQOL-BREF do not directly address these natural features of one's environment so it is not possible to establish if the current findings support or refute previous research. The findings of the current study do suggest that non-natural aspects of one's environment such as transportation and safety appear to be unrelated to CTN. It is possible that if elements of one's environment more closely related to nature were examined, such as access to outdoors activities or the presence of parks and gardens, then there may be more of a relationship found between environment and CTN.

The lack of statistically significant correlations between CTN and the Social Relationships facet of QOL does not support previous research indicating that a sense of community and strong interpersonal relationships can contribute to values of

environmentalism (Marcus et al., 2011). However, there is a difference between the construct of environmentalism used in that previous research and the current construct of CTN. While environmentalism only taps values and beliefs towards nature, CTN also contains an emotional and experiential component. Therefore, while the current findings do not fall in line with previous research, the construct measured was new in this exploratory study and should not be considered a direct contradiction. Based on these findings, it appears that the quality of one's social relationships is not directly associated with CTN.

In addition, one's sense of satisfaction for their overall health appears to be unrelated to overall CTN based on the results of this study. Similarly, physical QOL appears unrelated to overall CTN. Since previous studies have found a relationship between exposure to nature and physical health, this finding is unexpected and contradicts previous studies. Previous research has concluded that experiences in nature directly relate to benefits for one's physical health (Chalquist, 2009; Frumkin, 2001), and that exposure to nature also supports healing (Moore, 1981; Ulrich, 1984). Since it is known that direct experiences in nature contribute significantly to CTN (Kellert, 2002), this finding contrasts with previous literature. This discrepancy could be accounted for by the operational definition of physical health as measured by the WHOQOL-BREF. Perhaps the aspects of physical health that were measured such as one's energy level, sleep, and ability to move around are unrelated to CTN yet other aspects of physical health may be related. And, while exposure to nature may be related to physical health, based on the findings of this study it is not appropriate to draw a similar connection

between CTN and physical health. It is also possible that since this population is younger and healthier than a normative sample the lack of findings may be due to a ceiling effect which restricts the range of scores regarding physical health problems.

The small positive correlation between overall CTN and psychological QOL as well as psychological QOL's significant prediction of overall CTN suggests a relationship between MH and CTN. Those with stronger sentiments of NR Experience also endorse a higher level of psychological health. This relationship will be examined in more detail in an upcoming section.

It is also important to note the significant positive relationship of NR experience with physical QOL, psychological QOL, and general QOL. It appears that this particular aspect of nature relatedness is associated with many aspects of QOL. Those who more strongly value experiences and direct participation in the natural world also endorsed stronger ratings for several facets of QOL. This is consistent with previous research linking direct experiences in nature with increases in health and well-being (Chalquist, 2009; Frumkin, 2001; Kaplan & Kaplan, 1989; Serpell, 1991). While NR Experience is not a direct measurement of one's level of contact with the natural world, it does show that those who are more interested in interacting directly with the natural world report a higher QOL than those who are less interested. It appears that both the cognitive and abstract aspects of CTN (NR perspective) and the personal aspects of CTN (NR self) are not associated with QOL. Perhaps one's QOL is more closely associated with experiences and actions in nature than how one intellectualizes the natural world or sees themselves fitting into the larger natural world. Future research could examine the

relationship between one's specific nature-related behaviors and the NR Experience scale.

Based on the results of this sample, the NR experience subscale is most closely related to domains of QOL, especially for QOL's overall, physical, and psychological aspects. This supports previous research on the importance of direct experiences in nature for the promotion of health and well-being. Overall CTN is largely unrelated to QOL except in the psychological domain. The built environment and social relationships subscales of QOL were found to be unrelated to CTN.

CTN and Mental Health

The descriptive statistics of the current sample for the SCL-90-R appeared similar in many ways to the normative sample (Derogatis, 1994). Consequently, effect sizes between the current and normative sample were all small. Since the normative and current samples appear to be similar, it is appropriate to apply findings derived from the normative sample for use in the current study.

It appears that NR Experience is the most related of the four NR scales to psychological distress. Like NR Experience and QOL, this subscale appears to be more related to health and wellness than other subscales or the overall score. As with the NR scale and the WHOQOL-BREF, one's sentiments towards directly interacting with the natural world are more closely related to health outcomes than one's personal sense of place in the larger natural world or one's sense of humanity's place in the larger ecosystem. This supports previous research linking direct experiences in nature with

gains in overall MH (Chalquist, 2009; Frumkin, 2001; Herzog & Strevey, 2008; Kaplan & Kaplan, 1989). More specifically, the current findings support previous research that contact with animals reduces stress (Siegel, 1990) and depression (Siegel et al., 1999), and that contact with plants improves MH outcomes (Jarrot & Gigliotti, 2010; Rice et al., 1998). Furthermore, the current findings regarding the importance of experiences in nature for MH are in line with previous research on the restorative effects of the natural world (Herzog et al., 1997, 2003) and the power of nature to reduce stress (Laumann et al., 2001). In addition, the current study supports previous research regarding the influence of experiences in nature to enhance well-being (Kaplan, 2001) and raise mood (Rader, 2009). The connection between NR experience and MH found in the current study is consistent with the available research connecting direct experiences in the natural world with positive MH outcomes.

Those who reported stronger ratings of NR experience tended to also demonstrate lower scores on the interpersonal sensitivity subscale. Therefore, those who expressed more of a desire to engage in direct experiences in the natural world were less likely to feel inadequate when compared to other people. Since no previous research has compared CTN to interpersonal sensitivity as measured by the SCL-90-R, this finding should be considered novel. While the correlation is low and the practicality of this finding is limited, future research investigating the relationship between experiences in nature and perceptions of social relationships may prove fruitful.

In addition, higher ratings of NR Experience are also associated with lower reports of depressive symptoms. It appears that the desire to engage in direct contact with

the natural world is associated with fewer symptoms of depression. This falls in line with previous research regarding direct experiences in nature and mood: rural inhabitants experience fewer symptoms of depression (Weich et al., 2006) and ownership of pets (a way of directly experiencing nature) is associated with decreases in depression (Siegel et al., 1999). The current finding is also consonant with research demonstrating that experiences in nature increase positive affect (Nisbet & Zelenski, 2011). Since the correlation between NR experience and depression is weak, the practical significance of this finding is limited. Future research should more closely examine the relationship between experiences in nature and depression.

NR Experience was also found to be associated with less phobic anxiety, and anxiety served as a significant predictor of NR experience. Since the natural world may be a frightening place for many people, this finding could indicate that those who desire experiences in nature are less fearful of nature's potential dangers. The current finding is also consistent with previous research documenting the stress-reducing impact of nature (Laumann et al., 2001; Rader, 2009) and may also be related to research documenting the reduction in sympathetic nervous system arousal which accompanies exposure to nature-related stimuli (Fredrickson & Levenson, 1998; Fredrickson et al., 2000).

It is interesting to note the small yet statistically significant correlation between NR perspective and somatization. Those who take in nature as part of their sense of self are also more likely to report physical complaints. No previous research has documented this specific finding but it is inconsistent with previous research demonstrating that somatization is associated with less empathy (Bellet, 2003). Perhaps those who are

sensitive to the distress associated with the mistreatment of our ecosystem also are more likely to express their own distress in physical ways. However, implications are limited due to the small effect size of this finding. Future research would be useful in further exploring this possible connection.

NR experience and overall NR were also associated with less Hostility in the current study. Additionally, hostility was also shown to be a significant predictor of overall NR. No previous research has documented these relationships. It appears that those who feel more strongly connected to the natural world experience less anger, aggression, and irritability. It could be that exposure to nature has a restorative effect on MH and promotes positive subjective well-being as suggested by previous research (Kaplan & Kaplan, 1989; Nisbet & Zelenski, 2011). Or, this finding could be accounted for by the stress-reducing and restorative capacity of the natural world (Herzog et al., 1997, 2003; Kaplan, 2001). However, these hypotheses should be tempered by the low correlations and effect sizes between hostility and CTN. Still, this finding opens the door to the possibility that experiences in the natural world may have a calming effect and nature could be utilized as an intervention to work with anger.

In addition, it should be noted that none of the NR scales were directly correlated with an overall measure of psychological distress: the Global Severity Index. However, based on the results of multiple regression, the GSI was found to be a significant contributor in the prediction of CTN. These somewhat contradictory findings are interesting in light of previous literature reviews which mention the overall benefits of exposure to nature for MH (Chalquist, 2009; Frumkin, 2001). It appears that although

there are certainly relationships between specific facets of MH and CTN, the connection between MH and CTN at the broad, global level is more ambiguous and requires more research to decipher.

Based on the data from this sample, one may conclude that CTN as a general, overall construct shares few direct ties to MH. However, the NR Experience subscale, which is more closely tied to an affinity for direct experiences in nature, was associated with fewer symptoms of mental distress across numerous domains including depression, hostility, and anxiety.

CTN and Predictors

QOL, MH, and demographic variables explain about 21% of the variance in overall NR and 35% of the variance in NR experience. Since no previous research has looked at CTN, MH, and QOL variables together, this method of analysis is novel in the literature. Thus, it is difficult to compare this finding to any previous research. It can be noted, however, that since the model only explains less than one quarter of the variance in overall CTN, it appears that there are many more factors involved that contribute to one's sentiments of connectedness to the natural world than simply MH, QOL, and some demographic variables. More specifically, previous research (Kellert, 2002) indicated that direct exposure and contact with nature is likely to be a strong predictor of CTN.

Similarly, the larger amount of total variance explained for NR experience than overall NR suggested that one's desires for direct experiences in nature may be more important in the prediction of health and wellness than more cognitive aspects of CTN. This is

supported by the significant contribution and relatively high beta weight of amount of exercise outdoors. This would seem reasonable in light of previous research documenting the importance of direct experiences in nature in the creation of a stronger relationship with the natural world (Kellert, 2002). Future research should examine this possibility.

It appears that MH, QOL, and some demographic variables predict a small yet significant amount of the variance in CTN. Although specific predictors were shown to be significant in the prediction of CTN and multicollinearity was dismissed as a possible concern, these findings should be interpreted with caution and hypotheses held tentatively until the appearance of supporting research. In addition, beta weights from many predictors are low, indicating relatively small contributions of individual predictors. More research would be beneficial in attempts to identify other variables which may predict CTN.

Limitations

The results and implications of this study depend on the efforts to minimize potential threats to internal, external, statistical, and construct validity (Campbell & Stanley, 1996). Construct validity was addressed by choosing measures which were able to demonstrate a history of reliability, validity, and use in previous research. While the WHOQOL-BREF and the SCL-90 measures can be considered to demonstrate strong internal and external validity and extensive use in previous research, less information is known about the NR Scale. While previous research has demonstrated the NR Scale's strong internal and construct validity, its use in research has been limited to only a few

studies with restricted populations (Nisbet et al., 2009, 2010; Nisbet & Zelenski, 2011). Still, for reasons noted in earlier sections, it was decided that this measure represented the best operational definition of CTN while still maintaining adequate validity.

In terms of statistical validity, efforts to control for potential Type I and Type II errors were carried out by choosing an alpha level of .05 and then by conducting a priori power analysis in order to select an adequate sample size. However, since multiple correlations were run over the course of analysis, the rate of Type I error was greatly increased. Therefore, it is likely that some correlations which were flagged as statistically significant in this study are spurious. Still, because this study was intentionally framed as exploratory research, the large amount of bivariate correlations is acceptable and necessary.

Internal validity may be limited by participant expectancies. Although minimal information regarding the study was presented, it is possible that participants were aware of the experimenter's hypotheses and research questions due to the overt nature of the survey research.

While many significant correlations were found, it is important to note that almost all could be classified as "weak" ($r < 0.30$). Thus, while statistically significant, by definition these weak correlations mean that CTN could account for no more than 9% of the variance in each aspect of MH or QOL ($R^2 < .09$). Therefore, it is important understand the limited practical significance of these findings. While these results may certainly be useful in the support or refutation of previous research, it would be premature to imply that these findings carry definitive practical meaning or clinically

significant effects.

It is possible that the restricted range of ages played a role as to why such low correlations were found. Also, because most of the subscales for MH lacked many participants who endorsed moderate or high scores of psychopathology, it is not possible to draw conclusions for CTN and MH for individuals who endorse strong ratings of psychopathology. This could also potentially limit the possibility of strong correlations and effect sizes between CTN and MH.

External and population validity is limited by the characteristics of the sample. It should be noted that this sample is largely one of convenience. Introductory psychology students volunteered to participate in the study from a wide variety of research options, and thus the sample is susceptible to selection bias. The sample was also composed of predominately college-aged, white, religious individuals from the Intermountain West. Even though participants represented a large and diverse section of the student body, not all English classroom teachers volunteered their classes for participation and thus those which chose to participate may not be representative of the larger introductory English or USU populations. Therefore, generalization to the student body of this university as well as external populations should be made with caution. Replication of this research with other groups is needed to reconsider limits on generalization.

Also, since these data are correlational, it is not possible to make any inferences regarding cause and effect of CTN and well-being. There is no way of knowing any path of causation, or if there is potentially an unknown factor influencing both CTN and health.

Implications

The goal of this study was to gain more information regarding the relationship between CTN and QOL, MH, and demographic variables. This will provide useful information to direct future research regarding efforts to increase overall levels of well-being as well as potentially provide direction in the promotion of increases in CTN and positive environmental behaviors. Based on the findings of this study, Overall CTN as measured by the NR scale appears to have some small yet significantly correlated relationships to measures of health and QOL. Considering the numerous factors which influence MH and QOL, this finding appears reasonable. Based on the results of multiple regression analysis, QOL, demographic, and MH variables still contribute significantly to CTN. It appears that, while minor, there is a direct connection between health and wellness with the concept of CTN.

One interesting finding concerned the important relationship of the NR Experience scale with characteristics of health and QOL. It appears that the value of desiring to directly engage with nature is more closely related to health outcomes than one's perceptions of humanity's place in the natural world (NR perspective) or one's personal views of their own relationship with nature (NR self). This is consistent with previous work demonstrating the importance of NR experience in the use of nature as a restorative environment (Nisbet & Zelenski, 2011) and the role of direct experiences in nature to improve cognition (Mayer et al., 2009). Based on the results of this study, NR Experience and the desire for direct experiences in nature appears to be an important element in the relationship of CTN and well-being.

In addition, differences in ethnicity and location of childhood home are associated with NR experience but no other measures of NR. Thus, it is possible that the value given to direct experiences in nature may vary in different groups.

Interventions designed to increase NR Experience, such as direct contact with the natural world, may demonstrate usefulness in increasing MH and QOL. Or, perhaps those who demonstrate higher levels of well-being are more interested in seeking experiences in the natural world. Due to the correlational, cross-sectional design of this study, such possibilities are only speculative.

Future Directions

Future studies could examine the possibility of manipulating CTN, more specifically the NR Experience scale, which was found to be the most closely related to well-being. This could be done directly through interventions in the nature or outdoor activities or indirectly through the “greening” of communities by the placement of parks, gardens, and other natural spaces. Since NR experience was related to MH, a closer examination of variables which could serve as potential mediators to this connection could be examined.

Given that the population was physically healthier than the normative sample for the measure of physical QOL, future research could include a wider range of physical QOL scores in order to see how CTN is related to health status. On a related note, it would be interesting to examine CTN in the context of disability. Perhaps those of different ability statuses have varying relationships with the natural world. Also, it may

be possible to design interventions involving CTN may be useful to improve physical health and well-being.

It also may prove fruitful to further investigate the difference in CTN between those from rural areas and those from nonrural areas to determine what specific factors of rural lifestyle contribute to higher ratings of CTN.

Since hostility and anger appeared to be negatively related to CTN, it may be interesting to further explore this relationship. This finding could be used in the creation of nature-based interventions for those struggling with anger or interpersonal problems.

In addition, it would be useful to examine CTN in a more diverse sample. Extending to a national or worldwide population may provide more information about people's relationships with the natural world and present a broader context for research regarding CTN and well-being. A wider range of ages and ethnicities may increase the capacity for generalization of these findings and potentially reveal any existing differences in CTN based on those variables.

Similarly, it would be useful to include individuals with stronger ratings of psychopathology and an endorsement of lower levels of QOL. This could potentially serve to produce stronger correlations and effect sizes as well as indicate a higher degree of practical significance for these findings.

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APPENDICES

Appendix A
Letter of Information

LETTER OF INFORMATION

Attitudes Toward Nature and Well-Being

Introduction/ Purpose Peter Tauber along with Professor Gayle Morse in the Department of Psychology at Utah State University is conducting a research study to find out more about attitudes related to connectedness to nature and well-being. You have been asked to take part because of your current enrollment in this course (PSY 1010, ENGL 1010, or FCHD 2400). There will be approximately 250 participants at this site. There will be approximately 250 total participants in this research.

Procedures If you agree to participate in this research study, you will be asked to complete the attached survey about your attitudes toward nature, quality of life, and well-being. You may answer only the questions you feel comfortable answering, and you may stop at any time. There is no penalty for withdrawing. **Please do not put your name or any other identifying information on the survey.** The survey should take approximately 20 to 30 minutes to complete. When the survey is complete, please return it to the designated administrator.

Risks The risks involved in your participation in this research are no greater than what you may experience in everyday life. There may be some discomfort answering some of the survey questions. These surveys ask questions about some demographic characteristics such as age, education, and strength of spiritual beliefs. Another survey has questions related to quality of life and another asks questions about general psychological well-being related to connectedness to nature. If you feel uncomfortable with these questions at any time you may withdraw participation.

Benefits As a participant, you may derive an immediate benefit from an increased level of self-awareness regarding your own attitudes and well-being. Or, there may be no immediate direct benefit to you. The investigator will benefit from an increased awareness of the relationship between peoples' attitudes and levels of well-being. Additionally, this research will serve to contribute towards the researcher's professional goals. In the future, this information may be used directly or indirectly to improve individuals' well-being.

Payment/Compensation If you are a student of Psychology 1010, you will receive course credit for your participation. Students of ENGL 1010 and FCHD 2400 receive course credit at the discretion of their instructor.

Explanation & offer to answer questions This letter of information serves as a brief explanation of this study. However, if you have any questions or research-related problems, you may reach Peter Tauber at (435) 797- 1466 or peter.tauber@aggiemail.usu.edu

Voluntary nature of participation and right to withdraw without consequence

Participation in research is entirely voluntary. You may refuse to participate or withdraw at any time without consequence or loss of benefits. You may be withdrawn from this study without your consent by the investigator if it appears that the study is causing you physical, mental, or emotional harm. If you withdraw before the study's completion, you will still receive credit for your participation.

Confidentiality This is an anonymous survey. Research records will be kept confidential, consistent with federal and state regulations. Records will be maintained in a locked file in a locked room.

IRB Approval Statement The Institutional Review Board for the protection of human participants at Utah State University has approved this research study. If you have any questions or concerns about your rights or a research-related injury and would like to contact someone other than the research team, you may contact the IRB Administrator at (435) 797-0567 or email irb@usu.edu to obtain information or to offer input.

Copy of Letter of Information If you would like a copy of this Letter of Information for your records, you may keep this copy.

Investigator Statement "Through this letter, the research study has been explained to the individual, including the nature and purpose and the possible risks and benefits associated with taking part in this research study. Any questions that have been raised have been answered."

Signature of Researcher(s)

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Appendix B
Demographic Questionnaire

Demographic Questionnaire

1. How old are you today (years)? _____
2. What is your Sex? (circle one)
 0 = Male 1 = Female
3. How would you classify the area where you were raised as a child? (circle one)
 1 = Rural 2 = Suburban 3 = Urban
4. How would you classify your ethnicity? (circle all that apply)
 1 = American Indian or Alaska Native 2 = Asian/Asian American
 3 = Black/ African American 4 = Hispanic
 5 = Native Hawaiian or Other Pacific Islander 6 = White
 8 = Other (specify) _____
5. Are you currently employed? (circle one)
 1 = Yes, full-time 2 = Yes, part-time 3 = Yes, Seasonally
 4 = No, I choose not to work at this time 5 = No, I cannot find suitable employment
 6 = No, I am retired
6. What is your parents' combined annual income? (circle one)
 1 = \$15k or less 2 = \$15k-\$25k 3 = \$25k-\$35k 4 = \$35k-\$45k
 5 = \$45k-\$55k 6 = \$55k- \$65k 7 = \$65k- \$75k 8 = \$75k- \$100k
 9 = \$100k +
7. How would you classify your religious beliefs? _____
8. How much do your spiritual and/or religious beliefs influence your daily life?
 1 2 3 4 5
 Not at all Somewhat Extremely
9. How often do you exercise in a natural setting?
 1 2 3 4 5
 Never Sometimes Very Often
10. How often do you exercise in general?
 1 2 3 4 5
 Never Sometimes Very Often
11. Are you a dog owner?
 Yes No
12. Do you own any pet at all?
 Yes No
13. Who is your instructor for this class? _____

Appendix C

Nature Relatedness Scale

Instructions: For each of the following, please rate the extent to which you agree with each statement, using the scale from 1 to 5 as shown below. Please respond as you really feel, rather than how you think "most people" feel.

1 Disagree strongly	2 Disagree a little	3 Neither Agree or disagree	4 Agree a little	5 Agree strongly
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- | | |
|--|---|
| <p>1. I enjoy being outdoors, even in unpleasant weather. _____</p> <p>2. Some species are just meant to die out or become extinct. _____</p> <p>3. Humans have the right to use natural resources any way we want. _____</p> <p>4. My ideal vacation spot would be a remote, wilderness area. _____</p> <p>5. I always think about how my actions affect the environment. _____</p> <p>6. I enjoy digging in the earth and getting dirt on my hands. _____</p> <p>7. My connection to nature and the environment is a part of my spirituality. _____</p> <p>8. I am very aware of environmental issues. _____</p> <p>9. I take notice of wildlife wherever I am. _____</p> <p>10. I don't often go out in nature. _____</p> <p>11. Nothing I do will change problems in other places on the planet. _____</p> | <p>12. I am not separate from nature, but a part of nature. _____</p> <p>13. The thought of being deep in the woods, away from civilization, is frightening. _____</p> <p>14. My feelings about nature do not affect how I live my life. _____</p> <p>15. Animals, birds and plants should have fewer rights than humans. _____</p> <p>16. Even in the middle of the city, I notice nature around me. _____</p> <p>17. My relationship to nature is an important part of who I am. _____</p> <p>18. Conservation is unnecessary because nature is strong enough to recover from any human impact. _____</p> <p>19. The state of non-human species is an indicator of the future for humans. _____</p> <p>20. I think a lot about the suffering of animals. _____</p> <p>21. I feel very connected to all living things and the earth. _____</p> |
|--|---|

Appendix D
WHOQOL-BREF

The following questions ask how you feel about your quality of life, health, or other areas of your life. I will read out each question to you, along with the response options. **Please choose the answer that appears most appropriate.** If you are unsure about which response to give to a question, the first response you think of is often the best one.

Please keep in mind your standards, hopes, pleasures and concerns. We ask that you think about your life in the last four weeks.

		Very poor	Poor	Neither poor nor good	Good	Very good
1.	How would you rate your quality of life?	1	2	3	4	5

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
2.	How satisfied are you with your health?	1	2	3	4	5

The following questions ask about **how much** you have experienced certain things in the last four weeks.

		Not at all	A little	A moderate amount	Very much	An extreme amount
3.	To what extent do you feel that physical pain prevents you from doing what you need to do?	5	4	3	2	1
4.	How much do you need any medical treatment to function in your daily life?	5	4	3	2	1
5.	How much do you enjoy life?	1	2	3	4	5
6.	To what extent do you feel your life to be meaningful?	1	2	3	4	5

		Not at all	A little	A moderate amount	Very much	Extremely
7.	How well are you able to concentrate?	1	2	3	4	5
8.	How safe do you feel in your daily life?	1	2	3	4	5
9.	How healthy is your physical environment?	1	2	3	4	5

The following questions ask about how completely you experience or were able to do certain things in the last four weeks.

		Not at all	A little	Moderately	Mostly	Completely
10.	Do you have enough energy for everyday life?	1	2	3	4	5
11.	Are you able to accept your bodily appearance?	1	2	3	4	5
12.	Have you enough money to meet your needs?	1	2	3	4	5
13.	How available to you is the information that you need in your day-to-day life?	1	2	3	4	5
14.	To what extent do you have the opportunity for leisure activities?	1	2	3	4	5

		Very poor	Poor	Neither poor nor good	Good	Very good
15.	How well are you able to get around?	1	2	3	4	5

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
16.	How satisfied are you with your sleep?	1	2	3	4	5
17.	How satisfied are you with your ability to perform your daily living activities?	1	2	3	4	5
18.	How satisfied are you with your capacity for work?	1	2	3	4	5
19.	How satisfied are you with yourself?	1	2	3	4	5

20.	How satisfied are you with your personal relationships?	1	2	3	4	5
21.	How satisfied are you with your sex life?	1	2	3	4	5
22.	How satisfied are you with the support you get from your friends?	1	2	3	4	5
23.	How satisfied are you with the conditions of your living place?	1	2	3	4	5
24.	How satisfied are you with your access to health services?	1	2	3	4	5
25.	How satisfied are you with your transport?	1	2	3	4	5

The following question refers to how often you have felt or experienced certain things in the last four weeks.

		Never	Seldom	Quite often	Very often	Always
26.	How often do you have negative feelings such as blue mood, despair, anxiety, depression?	5	4	3	2	1

Appendix E

Histograms for Distribution of NR Scale Scores

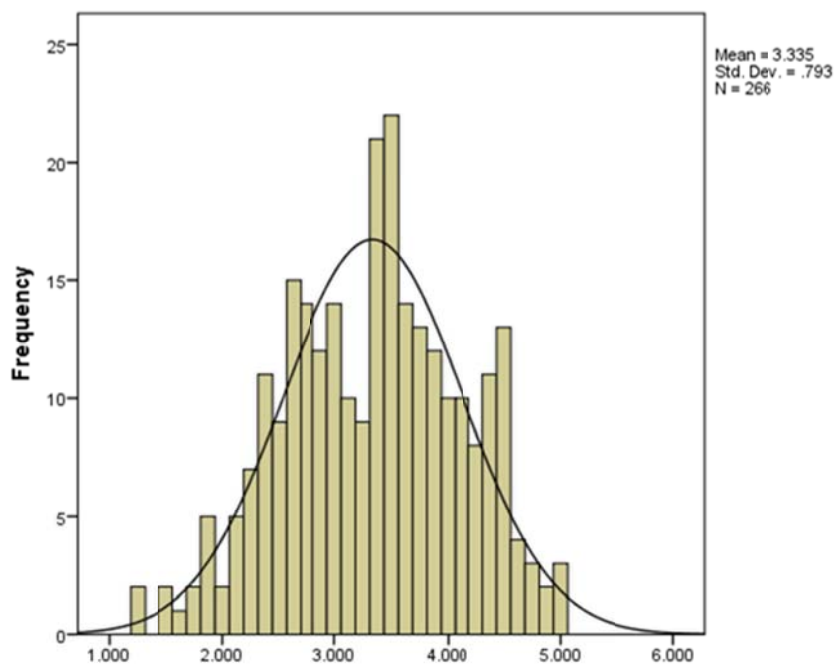


Figure E-1. Distribution of NR "self" scale scores.

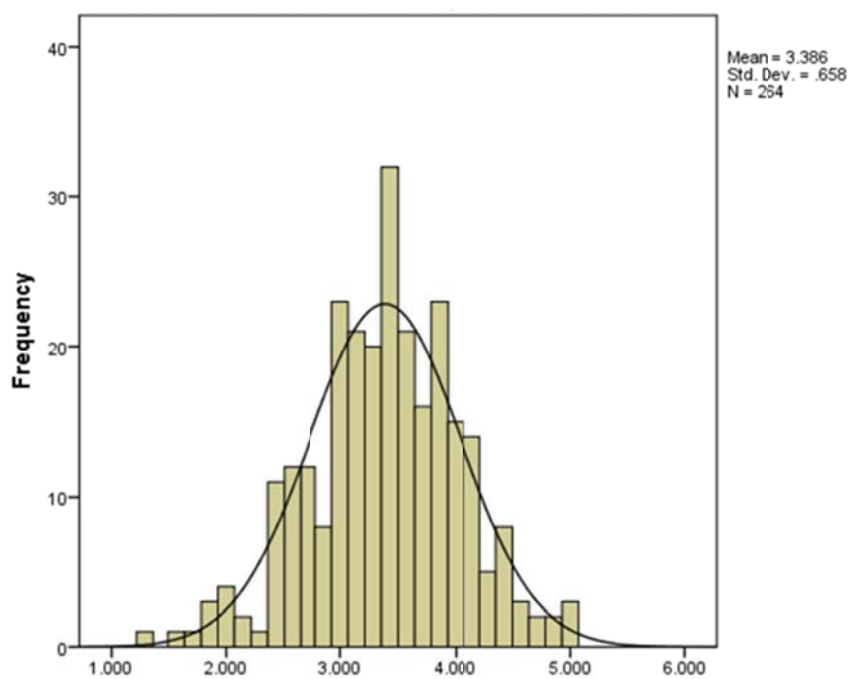


Figure E-2. Distribution of NR "perspective" scale scores.

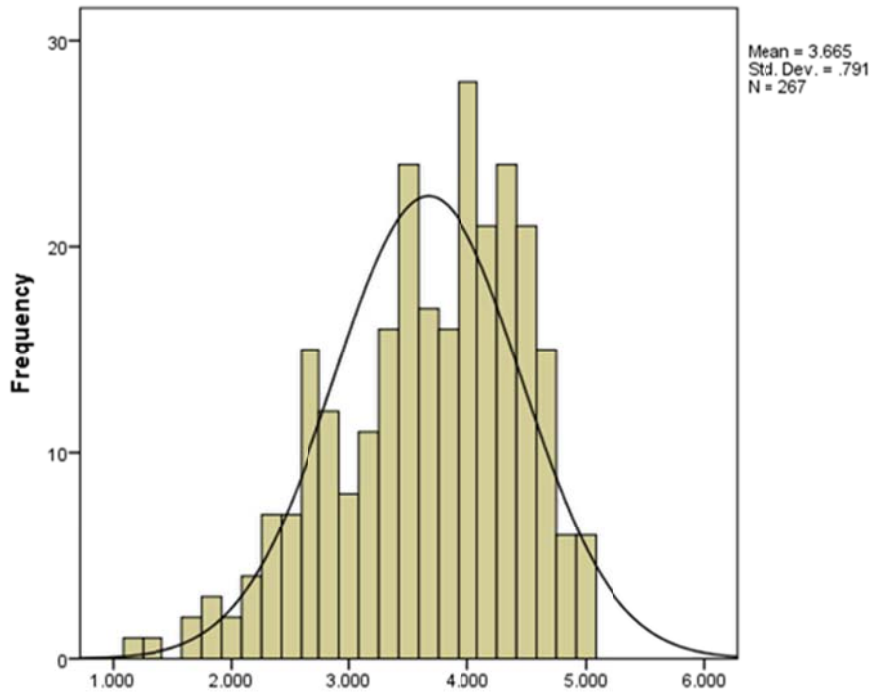


Figure E-3. Distribution of NR “experience” scale scores.

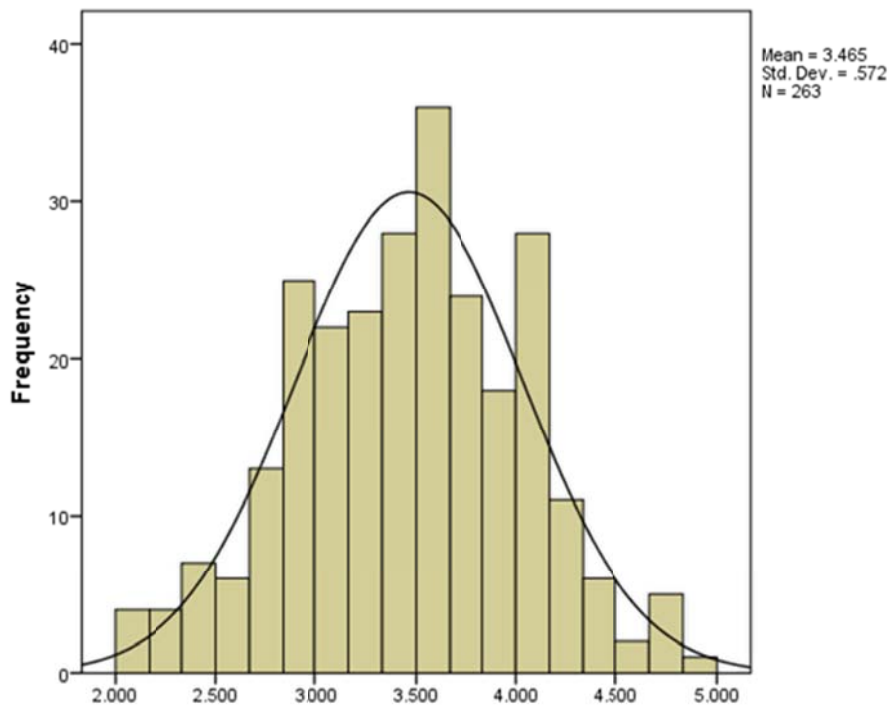


Figure E-4. Distribution of NR “overall” scale scores.

Appendix F

Histograms for Distribution of WHOQOL Scale Scores

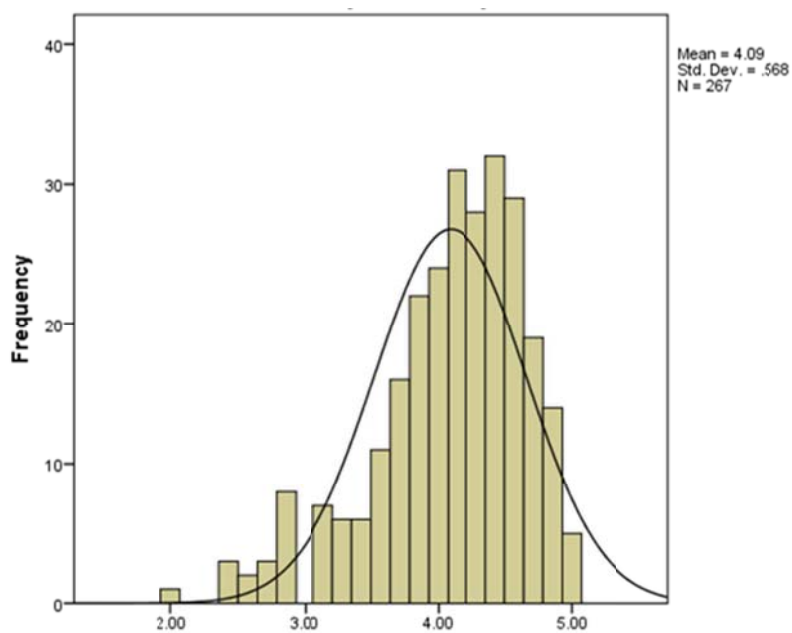


Figure F-1. Distribution of WHOQOL “physical” scale scores.

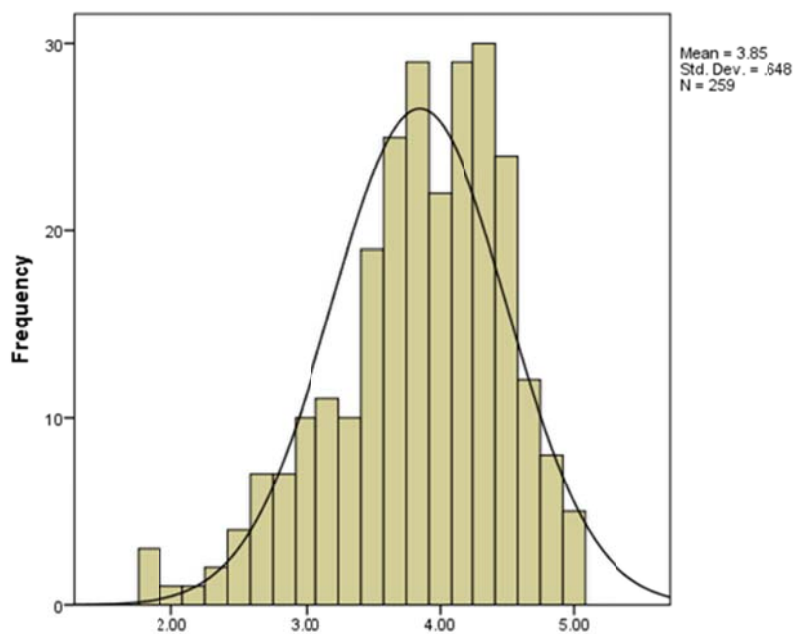


Figure F-2. Distribution of WHOQOL “psychological” scale scores.

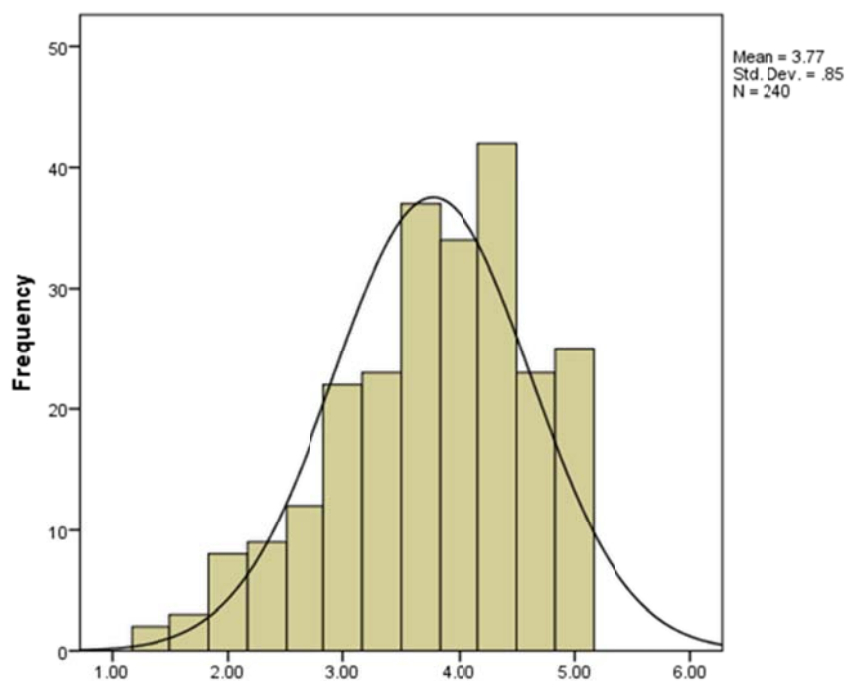


Figure F-3. Distribution of WHOQOL “social relationships” scale scores.

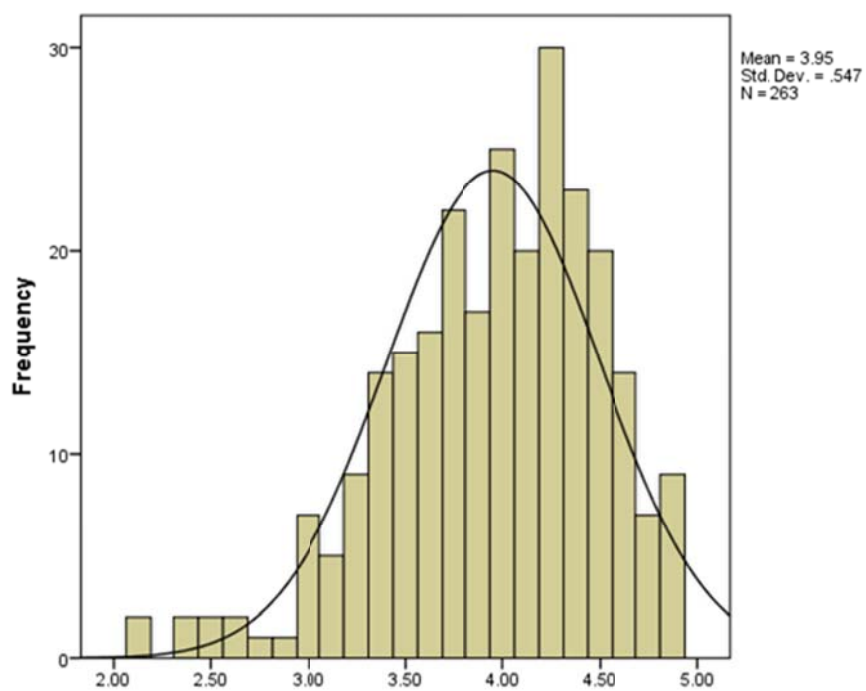


Figure F-4. Distribution of WHOQOL “environment” scale scores.

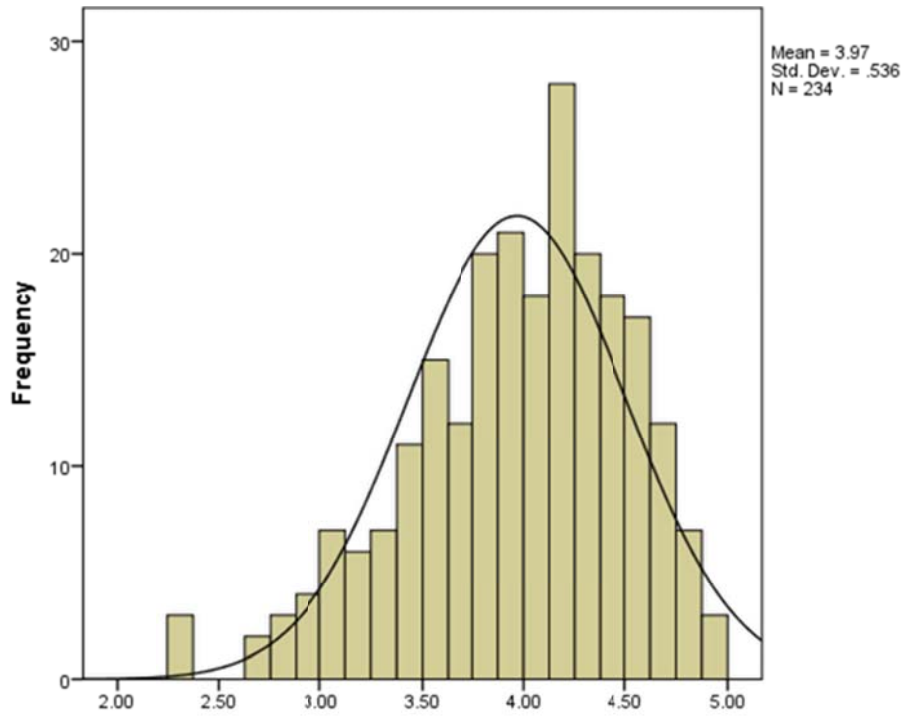


Figure F-5. Distribution of WHOQOL "overall" scale scores.

Appendix G

Histograms for Distribution of SCL-90 Scale Scores

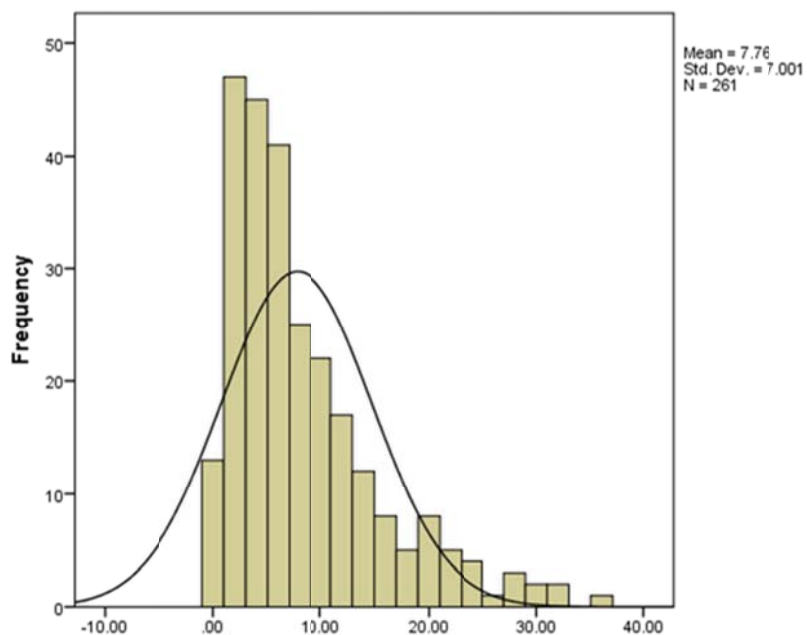


Figure G-1. Distribution of SCL-90 “somatization” scale scores.

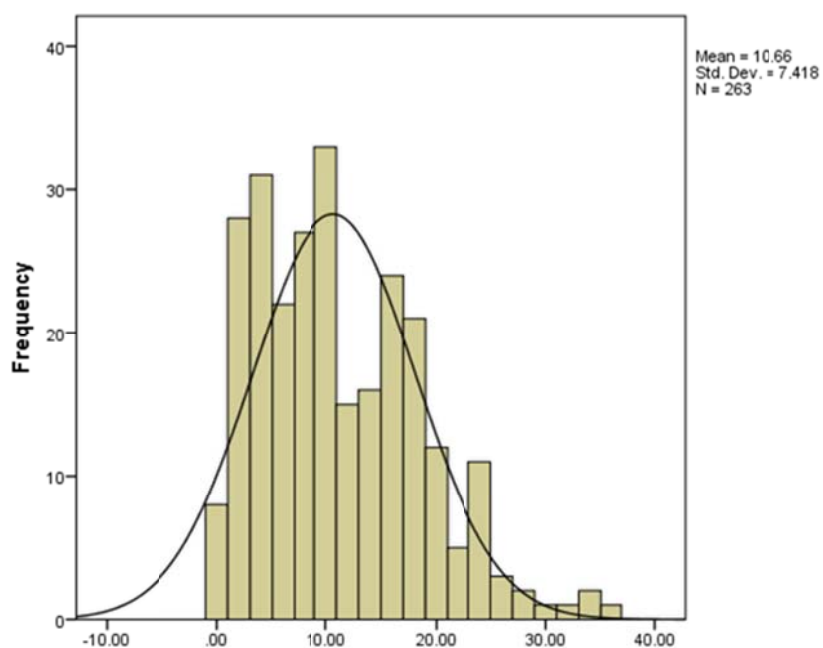


Figure G-2. Distribution of SCL-90 “obsessive-compulsive” scale scores.

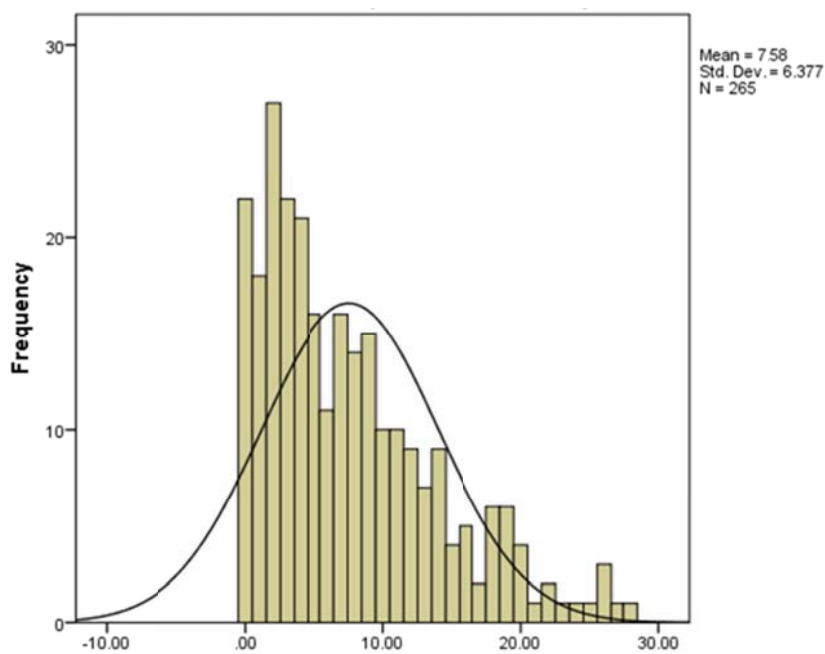


Figure G-3. Distribution of SCL-90 "interpersonal sensitivity" scale scores.

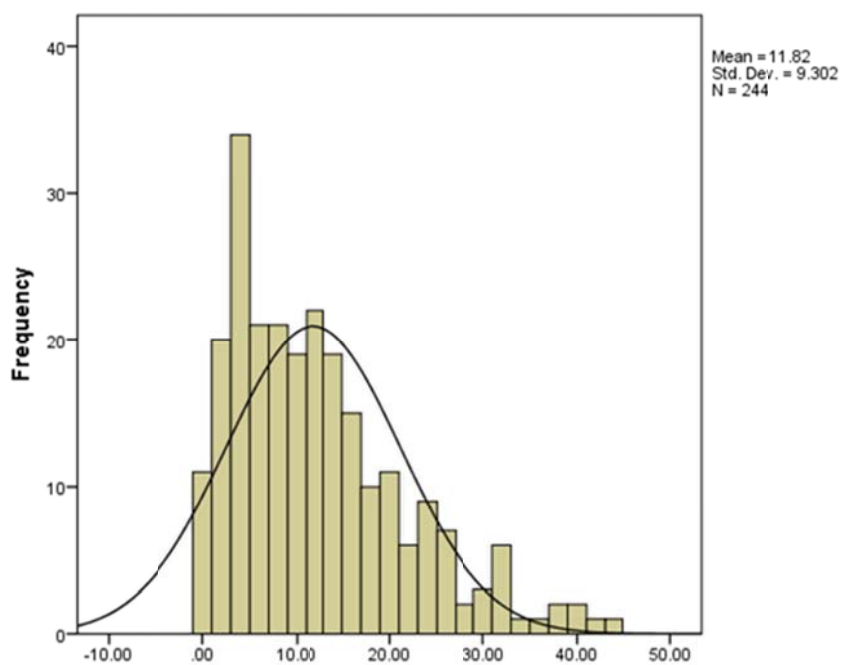


Figure G-4. Distribution of SCL-90 "depression" scale scores.

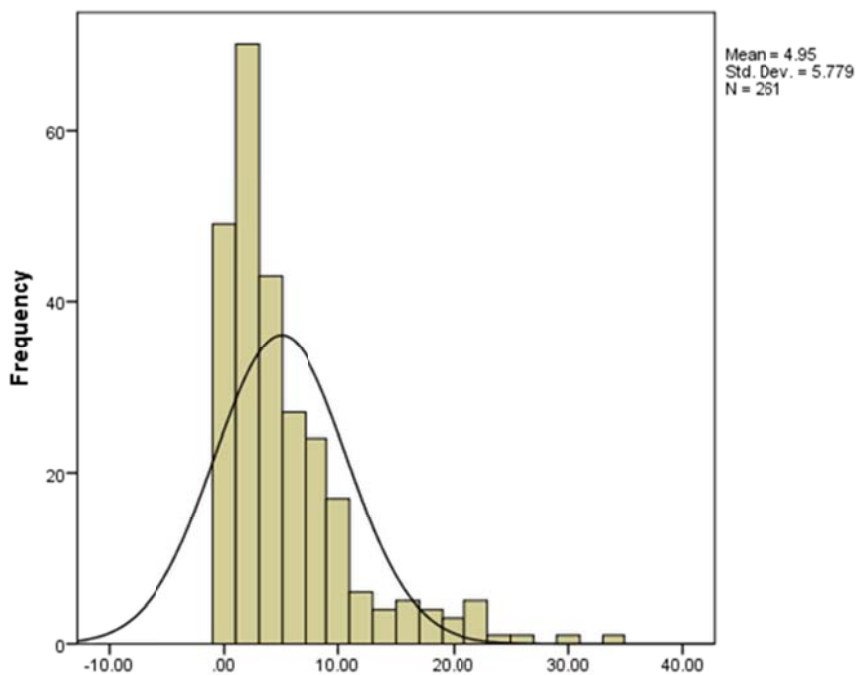


Figure G-5. Distribution of SCL-90 "anxiety" scale scores.

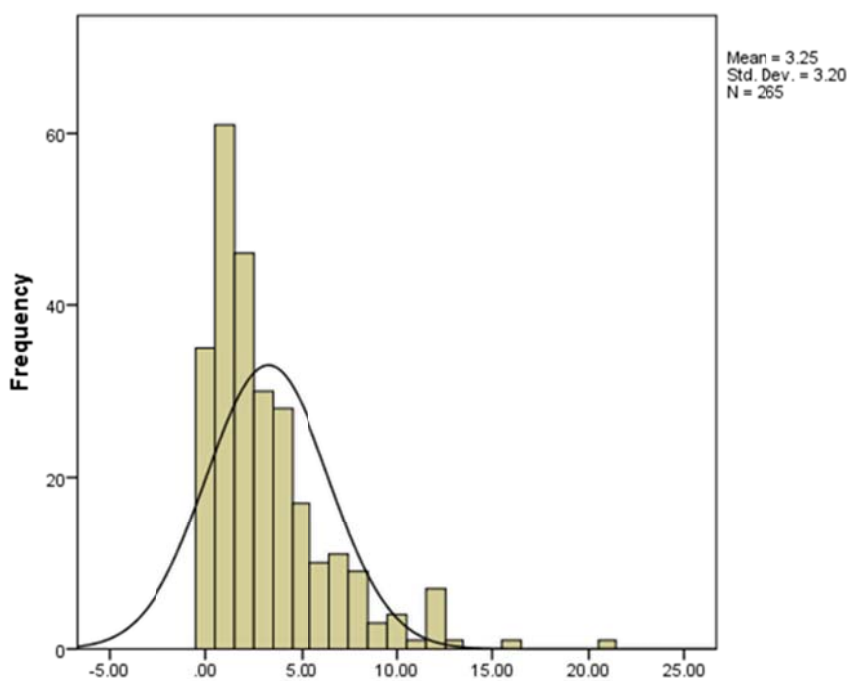


Figure G-6. Distribution of SCL-90 "hostility" scale scores.

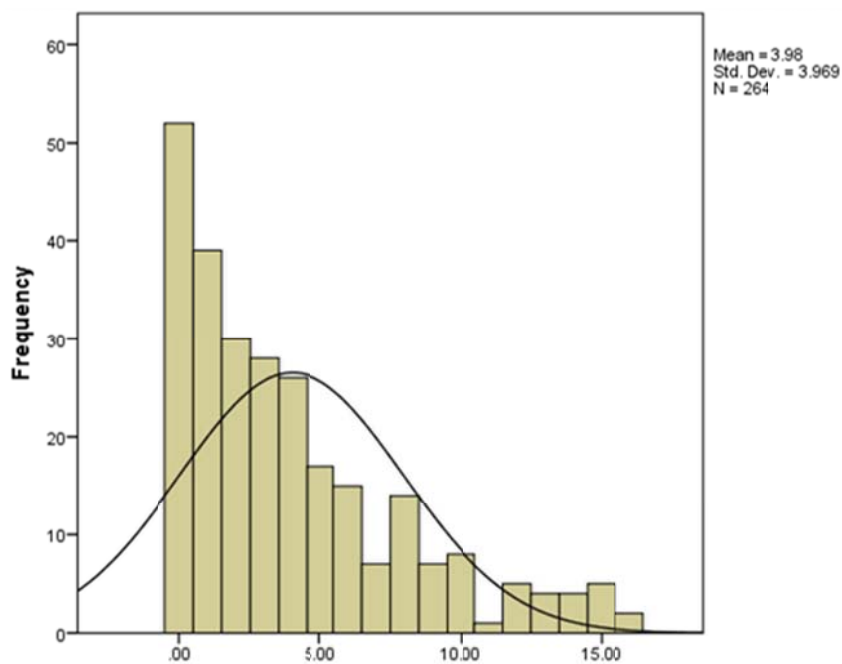


Figure G-7. Distribution of SCL-90 "paranoid ideation" scale scores.

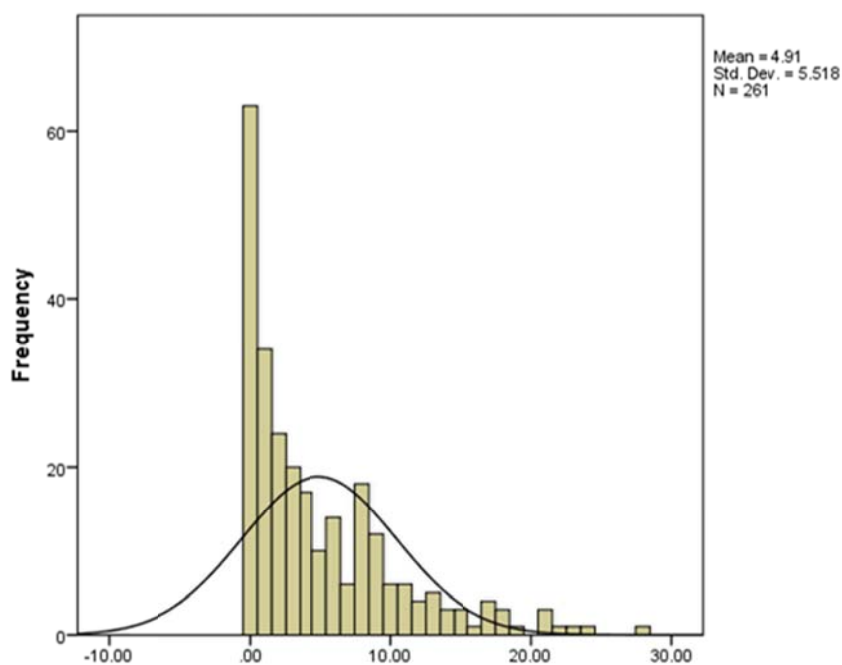


Figure G-8. Distribution of SCL-90 "psychoticism" scale scores.

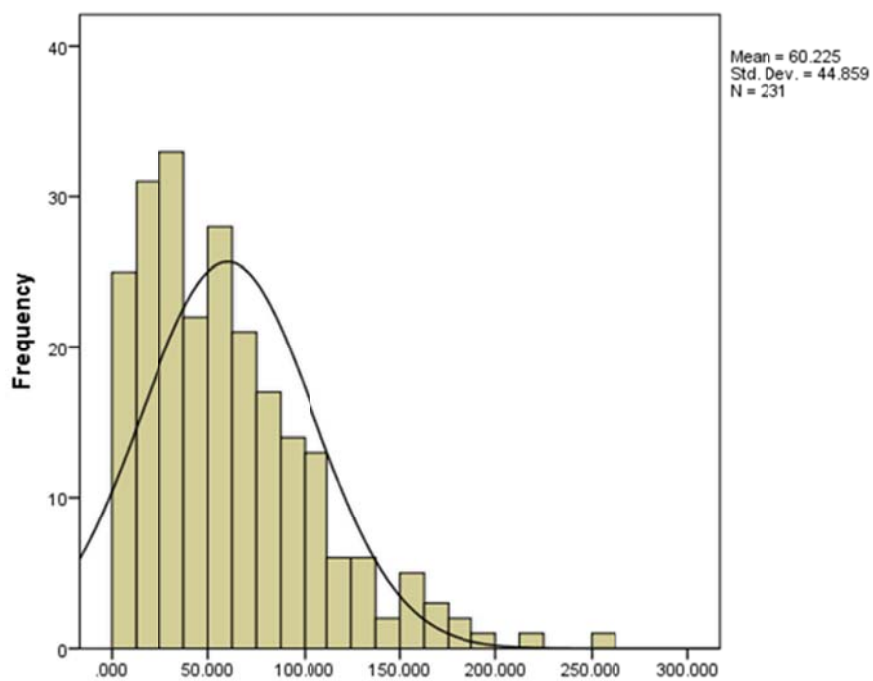


Figure G-9. Distribution of SCL-90 "global severity index" scale scores.