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Guidelines for environmental considerations in occupational therapy home programs for arthritis

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Guidelines for Environmental Considerations in
Occupational Therapy Home Programs for Arthritis

by

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Approval Page

This Scholarly Project Paper, submitted by Lori Pachl in partial fulfillment of the requirement for the Degree of Master's of Occupational Therapy from the University of North Dakota, has been read by the Faculty Advisor under whom the work has been done and is hereby approved.

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August 30, 2007
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Title: Guidelines for Environmental Considerations in Occupational Therapy Home Program for Arthritis

Department: Occupational Therapy

Degree: Master's of Occupational Therapy

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ABSTRACT

Problem:

Occupational therapists frequently provide service to patients with arthritis within a variety of settings. The symptoms of arthritis can be detrimental to a patient’s ability to participate in their daily functional activities. Pain, limitation in motion and decreased strength frequently disrupt the individual’s ability to complete daily activities which can have a depressing affect. Historically through today, patients report that these symptoms increase with changes in weather conditions.

Changes in barometric pressure, humidity, cold temperatures and levels of precipitation have been reported by patients to affect their arthritic symptoms and pain levels (Aikman, 1996; Guedj, 1990; McAlindon, 2007; & Jamison, 1995). These increases in pain and symptoms have created curiosity of the legitimacy of the complaints.

Traditional occupational therapy (OT) treatment generally focuses on the symptoms and limitations that the disease process targets within the exacerbation period. Minimal focus has been provided to the circumstances within each individual’s environment, such as weather, for provision of treatment.

Methodology:

This scholarly project focused on a review of the literature exploring the research to see if there is a relationship between pain and weather condition changes for persons
suffering from arthritis. Research regarding pain levels based on changes in barometric pressure, humidity, and temperature was also reviewed. Traditional occupational therapy home program treatment and non-traditional or complementary interventions for arthritis were also reviewed.

Findings:

The research for the topic of arthritic pain and its relation to changes in weather patterns has conflicting reviews; patients continue to frequently report changes in their ability to complete their daily tasks. Pain, or the perception of pain, in relation to changes in weather and environmental conditions, directly affects an individual's ability to perform functional daily living activities. Patient’s perceptions, of these factors needs to be considered in the provision of interventions as clinicians design their holistic approach to treatment. Research studies reveal that psychological factors can influence pain responses during functional activities when dealing with arthritis (Gueskens, Burdorf, Evens, Hases, 2008; Peat, 2008; Braun, Lian, Orav, Ohern, Barsky, 2008; Sale, Ginnac, Hawker, 2008). So even though there are conflicting results in the research there still is supporting data in over 50% of the research reviewed. This is significant enough to still consider the role of weather as a contributing factor. Complementary therapies do not have the same level of research outcomes to support their application as traditional therapies but that does not diminish the possibilities of positive influences by complementary interventions when combined with traditional.

The Guidelines for Environmental Considerations in Occupational Therapy

Home Programs for Arthritis was developed to provide ideas for the clinician regarding complementary treatment ideas in conjunction with traditional home program methods.
These complementary treatment ideas are based on consideration of weather patterns that are reported often by patents to impact arthritic changes. Occupational Therapists can use this as a guide to help patients make decisions on home program activities, based on their environmental weather conditions, to enhance their daily lives.
CHAPTER I
INTRODUCTION

Occupational therapists (OT's) frequently provide service to patients with arthritis within a variety of settings where the symptoms of arthritis can be detrimental to daily functional activities. Pain, limitation in motion and decreased strength frequently disrupt the individual’s ability to complete daily activities. Patients often report that many of these symptoms increase with changes in weather conditions.

Traditional treatment generally focuses on the symptoms and limitations that the disease process targets within the exacerbation period. Minimal focus has been provided to the circumstances within each individual’s environment for provision of treatment.

Project Description

This project explored and described the detrimental affects of arthritis and the debilitating consequences of the disease process. It also explored the research regarding the physiological affects on the joint in reference to outside factors such as environmental weather conditions. The research is inconclusive as to the degree of the relationship between weather conditions but over 50% of the research data does indicate a relationship. Based upon these results The Guidelines for Environmental Considerations in Occupational Therapy Home Program for Arthritis was designed. It is based on individual lifestyles and environmental weather conditions striving for an optimal outcome to reduce pain, limitations in motion, and decreased strength. The guideline provides a review of the traditional occupational therapy home program.
approaches designed to maximize function and minimize pain for those afflicted with the symptoms of arthritis. It describes complementary approaches to further minimize the symptoms of arthritis, based on the environment and weather conditions of the patient’s community integrated within the traditional approaches of home programs to enhance the function of daily living.

**Theoretical Base**

The theoretical approach in the design of this scholarly project is the Model of Human Occupation (MOHO) developed by Dr. Kielhofner (Kramer, Hinojosa, & Royeen, 2003). This model presents specific reasoning for motivation within an occupation, patterning of the behavior within the roles of the occupation, performance skills needed for the occupation, and environmental influences on the occupation (Kramer, et al 2003).

MOHO utilizes the volitional process involved with participation in an activity. The process includes the anticipation, choosing, experiencing and interpretation of the activity. When working with individuals suffering from the effects of arthritis, this process is magnified when pain is limiting the desired activity. The outcome changes as the individual experiences pain, particularly when weather conditions impact the choices and availability of activities.

Providing complementary interventions, in reference to weather and environmental conditions, may assist in the volitional choices and positive outcomes for individuals with arthritis. This guideline presents the traditional home program interventions integrated with complementary interventions to enhance the function and participation in the individual’s occupations.
Key Concepts and Terms

The following section presents the key concepts and terms presented throughout this scholarly project.

**Adaptive equipment:** gadgets used to minimize pain, stress and effort as well as to optimize positioning during functional activities (Hunter, 2000)

**Arthritis:** The word “arthritis” is defined as “inflammation of the joint.” “Arth” comes from the Greek word meaning joint and “itis” means inflammation or infection (Lorig, 2000, p 3).

**Balneotherapy:** heat modality which combines hydrotherapy with a mineral based water (Kavunku, 2004)

**Barometric pressure:** the force per unit area exerted against a surface by the weight of air above that surface at any given point in the Earth's atmosphere (Thomas, 2004)

**Bursa:** small sac near the joint that contains a liquid that lubricates muscle movement (Lorig, 2000)

**Cartilage:** a fibrous tissue that provides protection and cushioning at the end of bones (Lorig, 2000)

**Cold packs:** cryotherapy completed using silica gel or sand – slurry mixtures encased in vinyl which is stored in a freezer (Michlovitz, 1990)

**Complementary:** alternative healthcare approaches that are used in conjunction with traditional practice (NCCAM, 2000).

**Energy conservation:** principles instructed to minimize fatigue during functional activities (Hunter, 2000)

**Erythrocyte sedimentation rate (ESR):** rate at which red blood cells precipitate in a period of 1 hour. It is a common hematology test which is a non-specific measure of inflammation (Patberg, 2004)

**Fibromyalgia:** characterized by the involvement of muscles and ligaments (Lorig, 2000)

**Fluidotherapy:** superficial heat agent utilizing convection air heat exchange with fine cellulose particles (Michlovitz, 1990)

**Holistic:** “In health care, holistic often refers to a focus on the whole being, and holistic providers view people and illness as multifaceted. Illness is addressed through an
understanding of not only biological but also social, behavioral, and spiritual factors, and with a variety of interventions" (Carlson, 2003, p. 3).

**Home Programs:** A home program is individualized for the patient and his or her particular diagnosis. “The general components of a home program are activity and exercise guidelines, work simplification, pacing, temperature precautions, social activity, sexuality, signs and symptoms of exercise tolerance, and/or a discussion of risk factors. The information should be pertinent to the patient’s lifestyle, including favorite activities, work, and/or hobbies with suggestions for resuming activity (Radomski & Latham, 2008, p. 1303).

**Humidity:** the amount of water vapor in the air (Thomas, 2004)

**Hydrotherapy:** superficial heat agent using warm water with agitation using a turbine in a tank or container (Michlovitz, 1990)

**Ice Massage:** cryotherapy method utilizing water in frozen paper cups which is rubbed over the skin using small overlapping circles (Michlovitz, 1990)

**Immersion:** cryotherapy method promoting immersion of the body part into cold water (Michlovitz, 1990)

**Interferential current:** electrical modality which utilizes two electrical stimuli with independent frequencies that work together to stimulate large impulse nerve fibers (Kavunku, 2004)

**Intra-articular pressure:** pressure within a joint capsule (Strusberg, 2002)

**Joint protection:** principles that are instructed to improve functional utilization of the muscles and joints efficiently to reduce stress, pain and fatigue (Mayo Clinic Patient Ed Material #1837, 2001)

**Ligament:** fibrous cords that attach bone to bone and create joint capsules (Lorig, 2000)

**Muscle:** elastic tissues that move bones (Lorig, 2000)

**Occupational therapist:** a health care professional whom provides meaningful and purposeful occupation to enable people with limitations or impairments to participate in everyday life. Occupational therapists work with individuals, families, groups and populations to facilitate health and well-being through engagement or re-engagement in occupation (Bureau of Labor, 2009).

**Osteoarthritis:** characterized by damage in the joint cartilage (Lorig, 2000)

**Paraffin wax baths:** superficial heat agent utilizing paraffin wax via a dip and re-immers or dip and wrap method (Michlovitz, 1990)
**Precipitation:** rain, sleet, hail, snow and other forms of water falling from the sky (Thomas, 2004)

**Rheumatologist:** physician devoted to the diagnosis and therapy of rheumatic diseases (Bureau of Labor, 2009)

**Rheumatoid arthritis:** characterized by an inflammation in the synovial membrane or “synovitis” (Lorig, 2000)

**Splinting:** utilization of orthotic devices to support, protect and optimally position joints (Hunter, 2000)

**Subatmopheric pressure:** (McAlindon 2007) the force per unit area exerted against a surface by the weight of air above that surface at any given point in the Earth's atmosphere.

**Subluxation:** an incomplete or partial dislocation of a joint (Hunter, 2000).

**Superficial hot packs:** referring to heat agent who utilizes gel packs kept warm through submersion in hot water (Michlovitz, 1990)

**Synovial Membrane / Synovial Sac:** a thin “saran-like” structure that protects the joint. It secretes synovial fluid which provides the lubrication for the joint (Lorig, 2000)

**Temperature changes:** referring to environmental or climate temperature changes (Patberg, 2002)

**Tendon:** fibrous cords that attach muscles to bones (Lorig, 2000)

**TENS:** electrical modality utilized for chronic pain relief (Kavunku, 2004)

**Traditional:** therapies that are accepted by the mainstream with research demonstrating positive outcomes and practice acceptance is widespread (Carlson, 2003).

**Vapocoolant sprays:** fluori-methane spray used as a cryotherapy technique by misting a fine spray over the skin (Michlovitz, 1990)

Chapter II presents the review of literature that was used to support the design of this product. Chapter III describes the process used in the product design. Chapter IV is an introduction to the product and then the product in its entirety. The Scholarly Project
culminates in Chapter V where the conclusions, recommendations and limitations are presented.
CHAPTER II
LITERATURE REVIEW

Introduction

Patients report that the symptoms of arthritis such as pain, limitation of motion and decreased strength, frequently disrupt their ability to complete daily activities (Hopkins, 1983; Smith, 1983; Hampson, 1993; McCarber, 1991; Mayo Clinic Reference #1837, 2001). It contributes to work loss, more pain and poor functioning in daily life than any other kind of human illness (Fries, p. 5, 1986). In addition to the complaints of pain from arthritis, patients consistently report a correlation between disabling symptoms and changes in weather conditions. This phenomenon has been the subject of various research studies historically as well as recently (Guedj, 1990; Shutty, 1992; Arbor, 1994; Jamison, 1995; Aikman, 1996; Gorin, 1999; Strusburg, 2002; Patberg, 2002).

Changes in barometric pressure, humidity, cold temperatures and levels of precipitation have been reported by patients to affect their arthritic symptoms and pain levels (Aikman, 1996; Guedj, 1990; McAlindon, 2007; & Jamison, 1995). These increases in pain and symptoms have created curiosity of the legitimacy of the complaints.

This project allowed for the exploration and consideration of the relationship between weather changes and arthritic pain. In addition, treatment techniques related to weather, were designed to minimize the symptoms reported with this disease process. Occupational therapy clinic and home program treatment generally focuses on the
symptoms and limitations that the disease process targets within the exacerbation period.

Minimal focus has been provided to the circumstances within each individual’s environment for provision of treatment. An extensive literature review was conducted of various topics inclusive of, but not limited to:

1. a basic definition of arthritis, the physiological/physical impact on the body and the individual for purposes of this scholalry project
2. relationships between weather patterns and arthritic symptoms, barometric pressure changes within joint space capsules,
3. effects of heat/cold on joint capsules and pain relief patterns
4. the available community resources to further provide options of treatment and prevention.

Arthritis

Definition

Arthritis is one of the most common medical problems in the United States with over 120 various types of arthritis identified. Each of these types of arthritis involve a joint in one form or another and each with various causes, symptoms and treatment (Mayo Medical Essay, 1992). It affects over 1 million Americans, however this number is increasing as the ‘baby boomers’ are approaching 60 years of age (Katz, 2002).

The word “arthritis” is defined as “inflammation of the joint.” “Arth” comes from the Greek word meaning joint and “itis” means inflammation or infection (Lorig, 2000, p 3). Therefore the definition of “arthritis” is inflammation or infection of the joint. This definition can be misleading as many forms of arthritis do not specifically involve an inflammation or infection in a joint. Rather, issues arise within the joint, the ligaments, tendons and/or muscles located near or around the joint. A ‘true arthritis’ involves an inflamed synovial membrane and joint. The major forms of arthritis are described by the joint part that is involved.
To better understand the impact of arthritis, definitions of the anatomy of a joint and its surrounding tissues is necessary. Listed below are terms frequently utilized in the descriptions of arthritis (Lorig, 2000, p.3-4):

1. Cartilage: a fibrous tissue that provides protection and cushioning at the end of bones.
2. Synovial membrane or synovial sac: the sac is a thin “Saran-like” structure that protects the joint. It secretes synovial fluid which provides the lubrication for the joint.
3. Bursa: small sac near the joint that contains a liquid that lubricates muscle movement.
5. Tendon: fibrous cords that attach muscles to bones.
6. Ligament: fibrous cords that attach bone to bone and create joint capsules.

In general, arthritis is described within three major categories: rheumatoid arthritis (RA), osteoarthritis (OA), or fibromyalgia (FM). Generally each type of arthritis involves a different part of the joint. The synovial membrane is typically involved in rheumatoid arthritis. It is characterized by an inflammation in the synovial membrane or “synovitis”.

In osteoarthritis, the joint cartilage is damaged. Fibromyalgia involves muscles and ligaments. Treatment for each type of arthritis varies depending on the individual and the associated symptoms. However, the overall treatment techniques are similar and effective for each type of arthritis. Each of these three major categories will be described in more detail in the following sections.

**Rheumatoid Arthritis** (RA)

The first category of arthritis is RA. The 1987 Revised American Rheumatism Association (ARA) Criteria for Classifications for Rheumatoid Arthritis are listed below (Symmons, Mathers & Pfleger, 2006). Rheumatoid arthritis is defined by the presence of at least 4 criteria out of the 7 criteria presented but criterial 1-4 must be present for at least
6 weeks. (Luthra, 2009). These criteria continue to be utilized today but it is currently under revision. These criteria are presented in the following:

1. Morning stiffness of joints lasting at least one hour before maximal improvement
2. Soft tissue swelling (arthritis) in at least 3 joint areas observed by a medical doctor (MD)
3. Swelling (arthritis) of the proximal interphalangeal joint (PIP), metacarpal phalangeal joint (MCP) or the wrist joints
4. Symmetric swelling (arthritis)
5. Rheumatoid nodules
6. Rheumatoid factor positive
7. Radiographic erosions/periarticular osteopenia consistent with RA in hand or wrist

In an oral presentation by Luthra (February 10, 2009) the following RA descriptors were presented:

1. RA occurs in adults with a diagnosis that is often made between twenties to fifties although children approaching adolescence can also be diagnosed.
2. It primarily affects females with a 3:1 ratio affiliation with women vs. men
3. It has a familial tendency with a worldwide distribution and prevalence of one percent of the population.
4. The synovial membrane of the joint is inflamed and bone is destroyed. Ligament, tendon, cartilage and joint capsule damage also occurs.
5. The joints are affected symmetrically involving both sides of the body. Main features include swelling, redness, warmth and pain.
6. The individual often reports tenderness, fatigue, stiffness, muscle aches and fever.
7. This form of arthritis becomes less aggressive with time and some deformities can be prevented.

Diagnostic testing includes a positive rheumatoid factor, blood tests, x-rays and an examination of the joint fluid (Luthra, 2009). General treatment primarily includes a plan to reduce inflammation, utilization of a balanced exercise program, joint protection, weight control, relaxation, heat, medications and sometimes surgery (Luthra, 2009).
**Osteoarthritis (OA)**

The second category of arthritis is OA. Lorig (2000, p.5) presents the following OA descriptors:

1. Characterized by cartilage degeneration and bone regeneration which may result in bone spurs.
2. Affects the hands, spine, knees and hips and may occur only on one side of the body.
3. Generally the prevalence is equal for males and females and few people are severely disabled.
4. The age of onset is generally from 45 years to 90 years of age.
5. Most people have some features of osteoarthritis with the normal aging process.
6. Individuals experience localized pain and stiffness. Bony knobs or nodules often occur at the end of joints of the fingers with a minimal presentation of edema. The specific form which results in nodules in the fingers can have familial tendencies.
7. The long term prognosis can vary with minimal pain for some individuals, whereas others indicate significant pain and disability.

The most common test utilized to diagnosis this form of arthritis is radiologic studies (Lorig, 2000). General treatment for osteoarthritis includes management of activity levels, exercise, joint protection, weight control, relaxation, heat and periodically medications and/or surgery.

**Fibromyalgia (FM)**

The third primary category of arthritis is fibromyalgia. Lorig (2000, p. 28-31) presents the following FM descriptors:

1. The anatomical pathology of fibromyalgia is uncertain.
2. Sleep disturbances and prolonged muscle contraction are symptoms that often occur in fibromyalgia.
3. The joints are generally not affected although tender points in joints are often noted.
4. Muscles, ligaments and tendons may be affected with individuals often reporting overall aching, morning stiffness and fatigue.
5. The symptoms usually improve over the duration of the disease process.
6. This form of arthritis does not generally result in significant physiological changes resulting in minimal overall permanent disabilities.
7. The general diagnosis occurs between 30-50 years, with prevalence in primarily women.
8. There is no specific evidence of heredity factors for fibromyalgia.
9. Tests to determine the diagnosis include tenderness in joints and blood tests to exclude other ailments such as thyroid tests and sedimentation rate.
10. General treatment includes exercise, heat, relaxation, and periodically medication for pain and sleep enhancement.

These are the classic clinical descriptions of the three main categories of arthritis. Diagnosis and treatment interventions are currently based only on these descriptors. This is where the questions arise, is there validity to the reports and complaints of patients that the weather does have an impact on their level of pain and ability to function? Is there validity just in the fact that patients perceive that they symptoms correlate with weather patterns? This next section of the literature review presents both the historic and current research that explores those questions.

**Relationship of Weather Patterns, Conditions and Arthritic Changes**

**Weather Patterns and Conditions**

The weather has long been believed to affect peoples health but often dismissed as coincidence or folklore. Assessing the relationship between weather and health can be difficult partly because the weather changes every day. The German weather service currently produces weather-based health forecasts which are aired alongside the weather forecasts. This has been a growing part of their programming since 1985 (EnviroZine, 2009).

A computer-generated weather-health map of North America has been developed as a prototype. It combines weather factors know to affect health such as temperature, humidity, atmospheric pressure (barometric pressure) and wind (EnviroZine, 2009, p. 2).
Defined

Weather patterns are strongly reflected by barometric pressure. “Barometric pressure is the weight exerted by the air around us. Rapidly falling barometric pressure generally signals the onset of stormy weather, and is believed to have a strong correlation with the potential for feeling aches and pains. Rising pressure may also affect some people” (Weather & Your Health, 2009, part I, pg. 1). Air pressure is higher at sea levels than at higher elevations such as mountain ranges. Barometric pressure varies with many factors with one of the most influential being temperature.

“Rapidly rising or falling temperatures are a hallmark of big weather changes, indicating underlying shifts in barometric pressure. Extremes in temperature, not just changing temperatures, can also affect the potential for feeling aches and pains” (Weather & Your Health, 2009, part I, pg. 2). The sun does not heat the Earth uniformly, resulting in various temperatures in different parts of the air. As air is given more heat, the molecules have more energy. With this increase in energy, the molecules move farther apart resulting in fewer molecules occupying the same space. The barometric pressure decreases as a result. Conversely, if the air temperature is lower, the barometric pressure will increase. Warm air, near the surface of the Earth, will tend to rise, expanding and cooling. Cooler air cannot hold as much water as warmer air.

In an area of low pressure, the air has a tendency to rise and as it rises, the water will condense and form clouds and rain. This upward motion means that there is less pressure from the air pushing down on the Earth or lower barometric pressure. This is why low barometric pressure is frequently associated with wet weather.
An area of high pressure is a section of air that is sinking. As the air descends, it warms. It is then able to hold more moisture. Therefore, this area of high pressure is often accompanied by fair weather. An area of high pressure is often associated with hot, clear, summer days, but it can facilitate fog, frost, and clouds. High pressure areas are generally larger and move slower than low pressure areas.

“Wind often results from big shifts in weather, indicating that barometric pressure and other factors may be changing rapidly” (Weather & Your Health, 2009, part I, pg. 2). Winds blow in attempts to combat the differences in air pressure and try to flow from a high to a low pressure. However, the rotation of the Earth and friction of the surface force the air around the pressure centers. The larger the difference in pressure, the stronger the winds will blow. However, winds in high pressure regions are generally weaker than those in low pressure regions. High pressure does not necessarily mean warm weather. A high pressure region can be trapped between two low pressure regions resulting in a cooling effect.

Humidity is the amount of water vapor in the air. It is “often expressed as relative humidity (absolute humidity) which is the amount of water vapor relative to the amount of moisture the air can hold at a given temperature” (Weather & Your Health, 2009, part I, pg. 2). An increase in relative humidity, especially in the summer, can lead to increased potential for aches and pains.

While many patients are emphatic that weather affects how they feel scientific studies linking pain to weather don’t always agree. Gaining this foundational information on the factors in weather is essential to understanding the influencing factors in the following research studies.
Research

Historically, study results of the effects of barometric pressure, temperature changes, precipitation and humidity have been contradictory. Various studies have been conducted to determine a correlation of different climate variables with an individual’s impression of weather sensitivity and the correlations of pain and climate conditions (Guedj, 1990; Shutty, 1992; Arbor, 1994; Jamison, 1995; Aikman, 1996; Gorin, 1999; Strusburg, 2002). Many of these studies utilized a questionnaire requesting information such as pain levels and sensitivity. Simultaneous weather data was incorporated and utilized to formulate correlations among the items.

Within the past 20 years various studies have found a positive correlation between reported painful arthritis symptoms and changes in the weather (Guedj, 1990; Arbor, 1994; Shutty, 1992; Aikman, 1996; Strusburg, 2002). Studies have been conducted throughout the world to determine the relationships between these factors (Schmidt, 1979; Guedj, 1990; Shutty, 1992; Curkovic, 1993; Arber, 1994; Jamison, 1995; Aikman, 1996; Quick, 1997; Gorin, 1999; Davis, 2003; Wilder, 2003; Sato, 2003; Verges, 2004; Patberg, 2004; McAlindon, 2007; Tsai, 2006).

The discrepancies of results often refer to the differences in information obtained from the subjects within the questionnaires as well as the type of data obtained regarding weather conditions. The studies also found varied data when comparing subject diagnoses such as osteoarthritis and rheumatoid arthritis in reference to reported pain in the weather conditions. Several of these studies are presented in the following section of the literature review progressing from a historic to contemporary research perspective.
Historic Studies

Guedj (1990) completed a study in Israel, to identify a positive correlation between pain and barometric pressure, temperature and rain in patients. The patients were diagnosed with various forms of arthritis including osteoarthritis, rheumatoid arthritis, and fibromyalgia. A questionnaire requested information about the severity of joint pain and swelling. It also requested information on their ability to complete activities of daily living using a scoring scale. The information was then compared to statistical weather data to formulate correlations with the pain, swelling and disability levels as related to the weather changes.

It was found that pain was affected positively by temperature, rain and barometric pressure in individuals with osteoarthritis. It also discovered that an increase in barometric pressure and temperature intensified pain in rheumatoid arthritis. Patients with fibromyalgia reported that changes in the weather pattern aggravated their pain levels. In patients with fibromyalgia, pain was affected by the effects of barometric pressure alone. This study reports that pain in various forms of rheumatic disease can be predicted at a high percentage when one or more of the weather variables are used. This phenomenon is reported by statements of rheumatic patients that believe that they can predict weather changes by their increased joint pain.

Shutty, Condiff & DeGood (1992) completed another study comparing pain with precipitation and temperature. This resulted in a similar conclusion as the Guedj (1990) study that identified a reported increase in pain in association with precipitation and temperature. The Weather and Pain Questionnaire (WPQ) was utilized with a comparison to the weather variables of precipitation and temperature. The results indicated that
patients reported increased pain during weather changes in the variables of humidity and temperature. Joint and muscle aches were the most frequently described symptoms during these weather changes. Patients who scored higher than the median, with the WPQ, were defined as “weather sensitive.” These patients reported greater pain intensity, longer time frames of pain problems, and more sleeping deficits than those patients with lower WPQ scores. No specific differences in gender, education level, disability status or general psychological distress were noted within this study. Shutty et al. (1992) concluded that patients could reliably identify which weather variables influenced their pain levels. However, the study did not specify which symptoms would be consistently affected.

Arber (1994) also completed a study in Israel researching the effects of the weather in relation to the initiation of a gouty arthritis episode. The hospital records were reviewed for individuals who experienced an acute gouty arthritis episode. Statistical weather data was then reviewed for each of the episodes with these patients. No specific subjective information was gathered from any patient, rather objective data with the gouty arthritis episode and weather data were compared. Objective medical information, including the presence of elevations in plasma uric acid levels, was obtained from the hospital records. This indicated a gouty episode resulting in the patient visit to the facility. This indicated that an arthritic response had occurred as documented within the gouty episode. This documentation verified the rationale for the visit to the hospital, therefore justified the date for the study. Objective weather data included information of mean day time, and the wet, dry, minimal and maximal temperatures at midnight and 12 noon, the barometric pressure and heat stress (wet temperature + dry temperature divided by two). The weather information was gathered and reviewed for the 5 days that preceded
the gouty attack. A positive correlation of specific changes in the weather patterns 5 days prior to the gouty attacks, generally on the fourth and fifth day preceding the attacks. This study revealed that climate changes before a change in the arthritic status may contribute to the acute episode. Therefore, weather conditions may play a role in the pathology of acute gouty arthritis exacerbations.

Historically, the controversy of the effects of weather has also resulted in opponents of the theory of pain resulting from weather changes. One such study that refutes any significance of pain related symptoms related to weather variables was completed by Jamison, Andersen and Slater (1995) This study consisted of information from participants from San Diego, CA, Nashville, TN, Boston, MA and Worcester, MA. The participants all had chronic pain of which 39 percent were diagnosed with arthritis. This study indicated that the majority of patients with chronic pain perceive this pain to be related to weather changes. However, there were no clear demographic variables or geographic regions that explained the weather sensitivity. This study did not find a correlation between reports of pain and weather conditions.

Jamison, et al (1995) indicated that the two most predictable factors for weather sensitivity included age and patient belief that they had the diagnosis of arthritis. Younger individuals tended to report pain sensitivity to weather changes. The reasoning for decreased frequency for older patients to report pain sensitivity is unclear. In this study it was uncertain if older individuals were less inclined to admit to weather sensitivity due to generalized decreased sensitivity or whether they are less bothered by changes in weather and climate changes.
In Bendigo, Australia, Aikman (1996) conducted a study to determine if there was a relationship between the pain and rigidity of arthritis and the weather variables of temperature, relative humidity, barometric pressure, wind speed and precipitation. Data was collected via a questionnaire with simultaneous statistics for the weather conditions. The subjects of the study included patients diagnosed with either rheumatoid arthritis or osteoarthritis. The results indicated that participants demonstrated an inverse relationship between temperature and symptoms. They also displayed a positive relationship from symptoms and relative humidity. Therefore this study reported an association between symptoms of arthritis and actual weather variables. Temperature, relative humidity and time of day, respectively, were the most significant factors affecting the pain and rigidity symptoms. Wind speed did not seem to be a factor in the description of symptoms. The results clearly indicated that pain and rigidity are significantly influenced by low temperatures and high relative humidity.

Gorin (1999) indicated a slight difference in pain perceptions with comparisons to weather variables including barometric pressure, relative humidity, temperature and hours of sunlight. The study found that pain severity levels increased during periods of cold weather with diminished sunlight. It also noted increased pain levels with high barometric pressures and daily changes of relative humidity. This study did state that the magnitude of these associations were rather trivial and did not indicate a significant weather to pain association. This study also suggested continued studies to include psychological factors within the factors of pain and weather change associations.

In Argentina, Strusberg, Mendelberg, Serra, & Strusberg (2002) attempted to find a correlation between climate variables and patient reported impressions of weather
sensitivity. The focus was on the 5 days preceding and following a painful arthritic episode. Each weather related factor was evaluated separately in this study. Patients reported a higher pain level with low temperatures and high humidity levels. The control group did not demonstrate a significant correlation. The results supported the theory that weather conditions do influence rheumatic pain, however, the results varied with diagnoses and weather sensitivity levels. The study concluded that patients with rheumatoid arthritis reported that pain was reflected negatively by temperature and positively by humidity and barometric pressure (Strusberg, 2002).

The significance of these historic studies is that people have reported an increase in pain in association with weather changes for numerous years. As data and technology has improved, researchers continue to research methods to address the concerns. Although technological advances have been made as the years have passed, variables continue with the type of data collected. More modern studies have tried to obtain objective data for these concerns and these more contemporary studies will be presented in the following.

**Contemporary Studies**

More recently, research has been conducted to provide additional support to the theory that changes in weather patterns effect pain levels with patients. Takahashi (2003) used controlled rats to determine if cold temperatures induced pain. The focus was to determine if there was a positive correlation between the facilitation of primary nerve fibers and cold hypersensitivity in chronically inflamed conditions. The results showed a positive correlation between decreases in temperature and nerve fiber stimulation from the nerves responsible for pain. It suggested that cold responses were increased in inflamed
rats and the proportion of responses increased in the inflamed rats as compared to the control rats.

Sato (2003) also used rats to determine the effects of barometric pressure on pain responses. Arthritic rats were exposed to low barometric pressure (20 mmHg below the natural atmospheric pressure) and low ambient temperature (7 degrees cooler than the control rats). The results indicated an increase in the number of hind paw withdrawals in response to noxious mechanical stimulation. The number of paw lifts in response to the noxious mechanical stimuli increased with the rats that were given a complete Freund's adjuvant solution (CFA) injection. The results of this study indicated that lowering the barometric pressure and ambient temperatures, within the range of natural environmental fluctuation, intensifies pain in arthritic rats. The control rats were not affected by these changes.

Wilder (2003) reported that overall they did not find evidence that weather is associated with pain. However, this study did find that women experience a relationship between weather and pain. These same results were not as strong when comparing men and the relationship between weather and pain. The study found that women, with osteoarthritis in their hands, had higher pain levels were scored during days of rising barometric pressure.

Verges (2004) reported evidence that individuals with osteoarthritis experience increased joint pain with a decrease in barometric pressure. Verges (2004) also indicated that meteorological variables affect pain in individuals with rheumatoid arthritis as well. This study suggested that low atmospheric pressure and low temperature increases the risk
of joint pain. The results strongly support the relationship of weather on joint pain in individuals with osteoarthritis.

Patberg (2004) completed a literature review of the effects of weather on reported increased symptoms of arthritis. Patberg (2004) found a relationship between the time spent outdoors and the symptoms of RA. He found that temperature and humidity influence rheumatoid arthritis variables such as pain, stiffness and erythrocyte sedimentation rate (ESR). Other weather variables were more controversial in correlations with these symptoms and weather conditions. He referenced the phrase “cold and wet is bad, warm and dry is good for RA patients” to be true for humidity (Patberg, 2004, p.1334). Patberg (2004) found that outdoor exposure was beneficial to individuals with RA. Humidity was also influenced by the evaporation from the skin. The choice of clothing was paramount in contributing to the body’s ability to allow ventilation over the skin. This factor then contributed to the humidity level directly over the skin which influences the symptoms of RA.

This study stated that with an increase in successive days in the cold, pain decreased. When a person was exposed to low outdoor temperatures and wore light clothing, an increase in pain was reported. The study stated that staying outdoors for 2 or more hours on days warmer than 6 degrees Celsius (42.8 degrees Fahrenheit) resulted in minimal changes in pain. Being outdoors on cool days briefly also had minimal effects on pain. Individuals spending more than 2 hours outdoors reported their pain to decrease. Patberg (2002) indicates that the longer the period of successive days of cold, the greater the decrease in pain.
A cool outdoor temperature as well as being outdoors will have a cooling affect on the skin and joints (Patberg, 2002). In general, the most frequently reported experience from individuals in the study was the sense of feeling chilly while wearing light clothing during light outdoor activities.

The main point stressed in the Pathberg (2004) article was the statement that being outdoors for 3 or more hours per day appears to have a beneficial effect on rheumatoid arthritis. Study participants who were outdoors for 3 or more hours per day in the cool temperatures reported decreased pain (Patberg, 2002). It is uncertain if this was due to vasoconstriction or an increase in cortisol (Patberg, 2002). A high level of cortisol increases blood pressure and blood sugar which results in decreased immune responses (Wein, 2000). The lowered immune response can result in arthritic flare-ups (Wein, 2003). However, decreased cortisol levels result in vasodilation, which may influence muscle relaxation and pain relief (Wein, 2003).

McAlindon, Formica, Schmid & Fletcher (2007), found that both changes in barometric pressure and ambient temperature directly influenced patient reports of pain severity levels. It reported consistent findings throughout various geographical locations and during various periods of time over the course of the study. Evidence indicates that an increase in barometric pressure and ambient temperature change resulted in an increase in pain severity. A change in pain level was consistently reported with a 10 degree decrease in temperature. Thus, an explanation was provided related to the temperature differences from indoors and outdoors. If an individual remains indoors during extremes of temperatures, this may limit the exposure of this effect. During cold weather, the pain effect may only manifest itself with those individuals who venture outdoors.
A positive correlation between pain symptoms and temperature changes was documented by Tsai (2006). In this study, individuals with the diagnosis of juvenile rheumatoid arthritis were requested to keep records of pain symptoms. These records were then compared to weather conditions such as barometric pressure, temperature, and humidity levels. They found that pain symptoms increased the day after the advent of a cold wave. The reports of joint swelling were not related to weather conditions. This study concluded that weather changes, such as the onset of a cold wave, may influence the experience of joint pain.

McAlindon et al (2007) referenced a study by Wingstrand (1990) that suggested that atmospheric pressure influenced the intraarticular pressure of a joint. The Wingstrand (1990) study suggested that a normal joint has an intraarticular pressure that is subatmospheric. When the intraarticular pressure was equalized to the atmospheric pressure, an increase in subluxation of the joint was noted. This suggests that the direct affects of atmospheric pressure, on joint biomechanics, play an additional role on joints that may be compromised via surgical joint replacements or generalized compromised joint articular cartilage integrity. This may further complicate the pain factors when considering changes in weather temperature and barometric pressures.

The research is inconclusive as to the degree of a consistent relationship between weather conditions but over 50% of the research data does indicate a relationship. The classic clinical descriptors' regarding arthritis has been presented. In addition, the research on a possible correlation between arthritic symptoms and the weather has been explored and described but what does this all mean to the patient's quality of life?
Impact on Quality of Life

Arthritis is the most relevant condition that limits functional activities (Hampson, 1993). It is a degenerative process acquired because of metabolic, mechanical, genetic and other influences (Oddis, 1996). The disease afflicts various parts of the body, however commonly affects the wrist, fingers and thumbs (Sweet, 2002). This creates difficulty with grasping and releasing of objects. Simple tasks such as opening jars, doing laundry, and getting into a car can be hampered by arthritis (Lorig, 2000). Often, social activities such as going out to dinner, out to coffee with friends or going to a movie can be troublesome due to these issues. People with arthritis may avoid new places because they do not know if the facility has chairs that they can easily get out of, or they may believe that the fatigue levels will impact their ability to enjoy themselves.

The four most commonly reported symptoms that limit everyday activities include pain, fatigue, stiffness and depression (Lorig, 2000). The effects of the pain, fatigue and stiffness can limit one's ability to complete a task, limit the progress of activities as well as contribute to general fatigue resulting in feelings of being overwhelmed.

Pain

The most common and debilitating effect of arthritis is pain which occurs for a variety of reasons. The destruction of physical tissues results in structural changes within the joints and/or surrounding structures (Phillips, 1990). This often produces pain in the local areas or general pain within the body. Pain can be increased with episodes of depression, anxiety, stress, poor sleep, deconditioning and poor nutrition (Melvin, 2002).

Completion of activities, that cause stress to the joint region for long periods of time, can increase pain in these areas (Lorig, 2000). For example, hand stitching one
button on a shirt may not be stressful to the joint or particularly painful. However, spending hours mending clothing and repairing buttons may cause pain that lasts several days. Increasing the physical load on a joint may also contribute to pain such as lifting or carrying heavy objects, general obesity, climbing stairs, and getting out of a chair (Lorig, 2000).

**Fatigue**

Fatigue is another common debilitating effect from arthritis. Several factors contribute to fatigue such as a lack of sleep, inadequate diet or lack of exercise. Fatigue can also occur with an inflammation in the joint, over-activity and over-exertion (Lorig, 2000). People with arthritis need to determine a comfortable level of activity to minimize their fatigue level. Each person needs to learn their own tolerance and limitations with their level of activity. What is comfortable for one person may cause fatigue in another. This knowledge of limitation is crucial for individuals with arthritis. If one is experiencing fatigue, they can examine their activity levels to determine excess exertion or duration of the activity. One area for consideration in prevention is that one’s diet may also contribute to the fatigue level. A nutritionally balanced diet is optimal and necessary for individuals to minimize their fatigue levels.

**Stiffness**

Muscle stiffness is another common problem associated with arthritis. Morning stiffness is often termed the “gel phenomenon” (Lorig, 2000). After a rest period or even just being motionless for a few minutes, one can notice stiffness and difficulty with movement. After a period of loosening up, motion becomes easier and less painful.
Depression

A frequently reported symptom of arthritis is depression (Lorig, 2000). The stress and frustrations involved in this disease process often result in depression. It can contribute to a vicious cycle of fatigue, pain and general life debilitation.

Occupational therapy is often vital to offset the pain in the performance of these tasks of daily living. Adaptations to these pain responses may assist in enhancing functional activity levels for patients affected by arthritis. The next section will present traditional OT home program intervention methods designed to minimize pain and maximize function as well as complementary approaches for consideration. Complementary is defined as alternative healthcare approaches that are used in conjunction with traditional practice (NCCAM, 2000).

Traditional OT Home Program Treatment

The goal of treatment for individuals suffering from arthritis is to minimize pain and its impact on patient function and quality of life (McCarberg, 2001). OT’s can assist individuals in optimizing functional activities even during arthritic exacerbations. General treatment primarily includes a plan to reduce inflammation, utilization of a balanced exercise program, joint protection, weight control, relaxation, heat, medications and sometimes surgery (Luthra, 2009). The development of a home program, training and use of assistive devices, increase in physical and mental endurance and independence in self-care are essential as well (Spencer, 1983).
Evaluation

Prior to the administration of any intervention, a comprehensive evaluation is completed. This includes a functional assessment of transfers, activities of daily living, range of motion, postural control, muscle strength, coordination and respiratory function (Hopkins, 1983; Hunter, 1990). The symptoms of arthritis, inclusive of inflammation, instability and contracture, may affect the results of the assessments. These factors are considered when the plan of care is developed. The patient, therapist and medical team contribute to the decisions in which therapy will be provided (Hunter, 1990).

Treatment

The rehabilitation of patients with arthritis involves a cooperative effort on the part of the patient, the caregivers, therapists and physicians (Daly, 1993). If treatment begins early in the course of the disease, the onset of functional decline and disability can be delayed or prevented (Daly, 1993).

The complexity of the disease process often complicates and limits an individual’s ability to complete activities in a typical or normal fashion. Pain, swelling, and general discomfort may impede the individual’s ability to complete daily tasks. This reduction in normal daily activity then results in further debilitation and dependence in self cares. The physiological affects of the disease process further complicate one’s ability to perform the tasks due to pain, swelling, fatigue, etc. (Sheldon, 1984). Pain can also be amplified by depression, anxiety, stress, poor sleep, deconditioning and poor nutrition (Melvin, 2002).

Patients’ engage in treatment interventions in a clinical setting following a referral by his or her physician. In addition to the modalities and interventions that occur under the
supervision of a registered occupational therapists, a home program is also designed as an important component of the total treatment and discharge planning process.

**Traditional Home Program Focus Areas**

The goals are established in the clinical setting are also foundational to the home program which is designed by the clinician for the patient. The home program is individualized for the patient and his or her particular diagnosis.

“The general components of a home program are activity and exercise guidelines, work simplification, pacing, temperature precautions, social activity, sexuality, signs and symptoms of exercise tolerance, and/or a discussion of risk factors. The information should be pertinent to the patient’s lifestyle, including favorite activities, work, and/or hobbies with suggestions for resuming activity (Radomski & Latham, 2008, p. 1303).

The following are considered traditional therapeutic interventions used in OT. These interventions are part of the clinical treatment and then often are modified for the patient to independently do at home either between clinical treatment sessions or post discharge from clinical sessions. This list is not all inclusive but often considered the primary interventions that become part of the home program.

1. **Range of Motion and Strengthening:** Common methods to sustain or improve an individual’s motion and strength include range of motion and assistive range of motion exercises. The patient is instructed on these in the clinic in preparation so they can continue these exercises at home.

   Strengthening exercises can also be utilized to enhance muscle strength utilizing general protective principles as well. Physical exercise can be beneficial by increasing an individual’s physical capacity rather than reducing the disease activity (Kavuncu, 2004). The duration and level of intensity of exercise is determined according to each specific individual case. Range of motion, stretching, strengthening, aerobic conditioning as well as functional daily activities are all examples of exercise.

2. **Joint Protection Strategies:** The use of joint protection strategies is another method of treatment for individuals with arthritis that is done in conjunction with range of motion exercises. Joint protection principles are instructed to individuals
to improve functional utilization of joints and muscles efficiently in order to reduce stress, pain, and fatigue (Mayo Clinic Patient Ed Material #1837, 2001). Occupational therapists educate individuals in the principles of body mechanics and joint protection by utilizing proper joint load distribution and products to minimize the risks for further joint and muscle damage (Mayo Clinic Patient Ed Material #1837, 2001).

3. **Energy Conservation:** Energy conservation education is provided to patients during treatment sessions to assist in their quality of life (Spencer, 1983). Patients often fatigue during functional activities and benefit from general principles to minimize this fatigue (Hunter, 1990; Lorig, 2000). This provides the ability to enjoy a variety of activities within their day. Energy conservation consists of teaching patients to pace activities, plan their day and activities, prioritize these tasks and utilize optimal positioning to minimize the fatigue levels throughout the day (Hunter, 1990).

4. **Splinting:** Occupational therapists utilize their expertise in splinting to assist individuals with arthritis. Splinting is provided with goals to support, protect and optimally position the joints for a specific time period during the day or night (Hunter, 1990). During the acute stage of the inflammation, splinting assists in sustaining the joint structures in proper alignment to minimize further injury and deformity (Sheldon, 1984). This proper alignment of the joints reduces joint stress and promotes support for the joints. Splinting can assist in decreasing the inflammation within the joint and thus reduce pain (Spencer, 1983). Joint stiffness is reduced with proper positioning of the joints allowing improved function for daily tasks.

5. **Adaptive Equipment:** utilization of adaptive equipment is beneficial for individuals with arthritis (Hunter, 1990). These items assist in the reduction of fatigue and joint stress. The utilization of adaptive equipment further reduces the potential for deformity through improved positioning (Hunter, 1990). Many daily tasks become less effortful and less painful with the implementation of specialized equipment and techniques (Lorig, 2000). This allows for the ability to participate in desired activities with improved energy resulting in increased independence in daily activities. An example of adaptive equipment could include a long handled shoe horn, dressing stick or a reacher. These items minimize the need to bend over to pick up items from the floor, reduce bending at the hip for dressing, etc. Adaptive equipment is also utilized in feeding. Large handled utensils minimize the need for a tight grasp on the spoon, fork, and knife thus reducing the strain and efforts on wrist and finger joints during mealtimes. Adaptive equipment also includes the provision of attachments to existing items such as the application of large, long handles to gardening equipment, enlarged extension bars on doorknobs, etc. (Lorig, 2000). Many items are available in local department stores or medical supply stores. Adaptive equipment within the household often promotes safety such as with the use of an elevated toilet seat, shower chair, or grab bar in the bathroom.
6. **Relaxation**: The promotion of a physiological relaxation response can assist in pain reduction. It encourages muscle relaxation which allows them to be less tense and easier and less painful to move. In addition to releasing muscle tension throughout the body, relaxation exercises help one to sleep better and feel more refreshed (Lorig, 2000, p.229). Examples include guided imagery, breathing techniques and passive and progressive muscle relaxation techniques.

7. **Massage**: Self Massage for Pain Relief is the use of gently applied pressure and stretching to an area of the body to relax tense muscle and improve movement, stimulate blood flow and nutrition to the skin, tissues and muscles. Self massage is useful in helping to relieve pain and muscle tension in localized areas of the body that are easy to reach (Lorig, 2000, p. 242).

8. **Patient Education**: All of the above mentioned modalities and forms of treatment require extensive patient education to ensure adherence to the desired recommendations. An important component of therapy is education which includes counseling patients in the nature of their illness and providing self help strategies that can be utilized to help minimize pain (Blumstein, 2005; Mayoux-Ben-hamou, 2008).

The debilitating effects of arthritis can influence an individual’s social relations and disturb involvement within the environment which can lead to unhappiness and depression (Sale, 2008; Gignac, 2008). These principles and treatment techniques are intended to minimize the psychological and physical implications of the physical debility that the disease process can create.

**Summary of Literature**

There are more than 100 types of arthritis. The evidence for associations with weather and pain reports is mixed. It is possible that different types of arthritis will respond differently to changes in barometric pressure and related weather conditions.

Although research on the topic of pain and its relationship to changes in weather patterns has conflicting reviews, there is still a significant number of research studies that have confirmed that for many people, weather does affect health. There is mounting evidence that certain health problems are aggravated or even brought on by the weather.
Pain, or the perception of pain, in relation to changes in weather and environmental conditions, directly affects many individual’s ability to perform functional daily living activities if not physically at minimum psychologically. Research studies have also revealed that psychological factors can influence pain responses during functional activities when dealing with arthritis (Gueskens, Burdorf, Evens, Hases, 2008; Peat, 2008; Braun, Lian, Orav, Ohern, Barsky, 2008; Sale, Ginnac, Hawker, 2008). Even if it is a matter of perception “there is a potentially important message in the connection many people notice between the weather and their arthritis. Understanding this better could lead to improved understanding in why arthritis develops and how better to treat it” (Shmerling, 2009, p. 2).

Proposed Program

Guidelines for Environmental Considerations in Occupational Therapy Home Programs for Arthritis

The review of literature resulted in the development of The Guidelines for Environmental Considerations in Occupational Therapy Home Programs for Arthritis. This product takes into consideration the information received from the results of the research presented in the literature review. Although the information varied from study to study, there are specific considerations that can be made to create an optimal treatment environment for each individual’s home program.

Project Description

The Guidelines for Environmental Considerations in Occupational Therapy Home Programs for Arthritis is based on individual lifestyles and environmental
conditions for an optimal outcome of pain reduction, improvements in motion, and increased strength as determined by the patient and their therapist. Patients continue to report that weather changes affect their function with daily activities. The research has been inconclusive with specific data in this regard but it does identify two areas more consistently that affect arthritis: barometric pressure and cold weather conditions.

The most influential weather condition noted to impact pain and limitation in function was changes in barometric pressure (Wingstrand, 1990). The research suggested that atmospheric pressure influenced the intra-articular pressure of a joint. The normal joint has an intra-articular pressure that is sub-atmospheric. When intra-articular pressure was equalized to the atmospheric pressure, the joint was more susceptible to subluxation which could lead to pain and further injury (Wingstrand, 1990). The direct effects of atmospheric pressure on joint biomechanics may compromise joint articular cartilage integrity. This may further complicate pain and function.

Research has noted increased pain reports with exposure to moist, humid, cold weather conditions (Patberg, 2004). Decreased intra-articular temperatures resulting from exposure to these cool conditions resulted in decreased functional range of motion in joints, increased pain, and decreased independence in daily activities unless activities were completed for at least 2 hours outdoors (Patberg, 2002).

Theoretical Base

The Model of Human Occupation developed by Dr. Kielhofner (Kramer, Hinojosa, Royeen, 2003). MOHO presents specific reasoning for motivation within an occupation, patterning of the behavior within the roles of the occupation, performance
skills needed for the occupation, and environmental influences on the occupation (Kramer et al, 2003).

This theoretical model utilizes the volitional process involved with participation in an activity. The process includes the anticipation, choosing, experiencing and interpretation of the activity. When working with individuals suffering from the effects of arthritis, this process is magnified when pain is limiting the desired activity.

The outcome changes as the individual experiences pain, particularly when weather conditions impact the choices and availability of activities. Providing creative options of activities within the restrictions of weather and environmental conditions may assist in the volitional choices and positive outcomes for individuals with arthritis.

This theory can also be incorporated into the patient’s processing of success with the available treatment options. Through the use of patient education, the process of understanding the traditional methods of treatment and the nontraditional or complementary, specifically identified approaches within their environmental conditions may improve overall goal attainment.

MOHO suggests that the patient also utilizes experiential learning and problem solving to enhance their outcome and positive end result. Tasks within the home program involve specific ideas in which the patient can improve pain, motion, etc. using both the traditional and complementary treatment recommendations. These can guide the patient and the therapist in the optimal activities to achieve the goals based on the successes and limitations experienced in the experiences.
Organization and How to Use the Guide

This guide is designed for the clinician who is interested in combining community based complementary aspects of home program activities with the traditional home program interventions.

1. For each section the research is summarized and presented so the OT has the most recent and relevant research data available at this point in the development of this project. The OT must realize, of course, that is will become his or her responsibility to remain current and update don’t eh information.

2. The complementary treatment options are listed with examples of environmental and community resources to enhance the traditional approaches to the OT home program.

3. The OT needs to then apply this information to their patient’s community and general weather patterns and integrate their lifestyle and community resources. Currently the guideline is specific to the author’s community as an example. Resources and options in the community must be explored and incorporated by the therapist.

4. The environment of the individual can impact the type of home program that is structured. Consideration for personal preferences in regard to available indoor and outdoor activities can impact compliance with suggested exercise and activity routines.

5. Clothing suggestions can be made in relation to weather conditions for optimal skin temperatures during these activities based on the research to minimize pain in the joints. Several examples of clothing suggestions is provided.

6. Home programs can be adjusted in accordance to the individual’s pain levels and ability to cope with their pain.

7. OT suggestions may also include strategies to cope with the stress of the pain and debility in addition to addressing the physical limitations.

8. Research also indicates that it may be beneficial to have the patient keep a weather/pain journal.

Weather is considered a possible influence on a wide variety of health conditions. Weather conditions can influence activity and independence levels with patients and the guideline considers environmental factors as well as community resources that may complement traditional treatment interventions. At this point, there is no information in occupational therapy that begins to take weather and related environmental factors in
consideration. Occupational therapists can utilize local weather conditions advantageously with patients in their daily routines as a guide, to develop more holistic home programming for their clients. It’s possibly a new practice approach that deserves to be considered, at minimum, because the patient has the perception that it does play a role and all treatment approaches begin with a theory and then research was gathered and documented to support or refute the theory. Research studies reveal that psychological factors can influence pain responses during functional activities when dealing with arthritis (Gueskens, Burdorf, Evens, Hases, 2008; Peat, 2008; Braun, Lian, Orav, Ohern, Barsky, 2008; Sale, Ginnac, Hawker, 2008).

The combination of traditional and complementary treatment techniques may enhance the success of pain relief for patients suffering from the debilitating effects of arthritis. The product is a guideline of environmental considerations or complementary approaches for occupational therapy to consider when designing and advising patients in home programs in conjunction with traditional approaches. The goals of these considerations or approaches are to further minimize the symptoms of arthritis based on the environmental and weather conditions of the community.

The methodology of the development of the product is presented in Chapter III.
CHAPTER III
METHODOLOGY

Overview

The Guidelines for Environmental Considerations in Occupational Therapy Home Programs for Arthritis was designed based on a review of the literature. The intent is to inform occupational therapists about the potential role weather and environmental conditions have in the treatment of arthritic conditions. The research literature confirms that there is a relationship between health and weather. Consideration of complementary interventions, incorporated into a traditional home program, needs to occur.

Overview

There is a significant percentage of research that supports weather has an effect on the symptoms of arthritis. Patberg (2004) completed a literature review of the effects of weather on reported increased symptoms of arthritis. He found that temperature and humidity influence rheumatoid arthritis variables such as pain, stiffness and erythrocyte sedimentation rate (ESR). Other weather variables were more controversial in correlations with these symptoms and weather conditions.

Patberg (2004) found that outdoor exposure was beneficial to individuals with RA. Humidity was also influenced by the evaporation from the skin. The choice of clothing was paramount in contributing to the body’s ability to allow ventilation over the
skin. This factor then contributed to the humidity level directly over the skin which influences the symptoms of RA.

Methodology

This topic became an area of interest due to the author’s son being diagnosed with juvenile rheumatoid arthritis. In addition, her experiences as an occupational therapist, for over twenty years, brought her into contact with numerous patients who perceived the connection between weather changes impacting their arthritic condition. The questions were then asked:

1. Is there validity to the reports and complaints of patients that the weather does have an impact on their level of pain and ability to function?
2. Is there validity just in the fact that patients perceive that they symptoms correlate with weather patterns?

An extensive literature review was conducted of various topics and attained information from professional literary sources, professional journal articles, professional websites and information from professional presentations.

The purpose of this literature review was to explore if:

1. a basic definition of arthritis, the physiological/physical impact on the body and the individual for purposes of this scholarly project
2. relationships between weather patterns and arthritic symptoms, barometric pressure changes within joint space capsules,
3. effects of heat / cold on joint capsules and pain relief patterns
4. the available community resources to further provide options of treatment and prevention.

The process utilized in obtaining information for this guideline included a literature review of statistical data related to weather and pain patterns in individuals dealing with arthritis. Historical data as well as recent research was reviewed. Research articles were reviewed in search of statistical data verifying the relationship between
weather conditions and reports of pain during outdoor activities. Research consisted of controlled studies involving current patients experiencing actual arthritis symptoms. Data was also obtained from studies using rats to determine pain reactions based on weather patterns and meteorological changes. These studies provided information in regard to pain responses that were unable to be performed on human subjects. This information was summarized with the noted findings.

A review of current occupational therapy practice guidelines used with arthritis patients was included in the process. The decision to include this information was made to show the necessity of current traditional home program interventions for patients experiencing arthritis needs to continue. This guideline does not replace traditional home programming approaches. It was also essential to show that albeit these interventions are effective, they can be maximized by the consideration of the patient’s lifestyle and environment. This allows the clinician to develop a more holistic home program which may increase compliance and successful outcomes.

Based upon the literature review The **Guidelines for Environmental Considerations in Occupational Therapy Home Programs for Arthritis** was designed. These guidelines are based upon the following information that is supported by research:

- Individuals suffering from arthritis often deal with debilitating effects from the disease including pain, limitations in motion and strength as well as loss of independence in functional activities. Many of these symptoms reportedly increase with the changes in weather conditions.
- Within the past 20 years various studies have found a positive correlation between reported painful arthritis symptoms and changes in the weather (Aikman, 1996, Guedj, 1990, Arbor, 1994, Shutty, 1992, Strusberg, 2002).
- Environmental factors may influence the pain experienced with subsequent inhibitions and attributes to the treatment of the disease processes associated with arthritis.
- Research studies have also revealed that psychological factors can influence pain responses during functional activities when dealing with arthritis.
Pain, or perception of pain, in relation to changes in weather and environmental conditions, directly affects many individual's ability to perform functional daily living activities. Occupational therapy utilizes pain management modalities, energy conservation techniques, joint protection, provision of splints and adaptive equipment to address the associated concerns. However, continued reports of pain with weather and environmental changes occur. Minimal focus has been provided to the circumstances within each individual’s environment for provision of treatment.

Occupational therapy frames of references and theories were then reviewed to determine application to this topic. The Model of Human Occupation developed by Dr. Kielhofner (Kramer, Hinojosa, Royeen, 2003) was chosen. This model fits perfectly as it presents specific reasoning for motivation within an occupation, patterning of the behavior within the roles of the occupation, performance skills needed for the occupation, and environmental influences on the occupation (Kramer et al, 2003).

The methods used for the development of the guideline included the incorporation of complementary approaches with currently effective home program approaches for the treatment of arthritis. Including these environmental and weather related factors is a sound idea since they may influence effective daily living approaches based on individual communities and their environments. The guideline incorporates the results of these project research processes into suggestions and ideas to minimize the pain and debilitating effects often reported when completing activities outdoors during changes in weather conditions. The research was utilized to assist in choices of activities that enhance the function of individuals suffering from the effects of arthritis.

Many individuals experiencing arthritis desire to be outdoors for functional activities. However, repeated reports of increased pain have been evident when these
individuals spent time outdoors but maybe this combination can make these experiences more positive. This guideline presents a variety of sedentary activities as well as active outdoor activity options. Patients receive occupational therapy when they are in different stages of their pain. This guideline accommodates activity levels based on the individual’s ability to mobilize and participate in functional activities. The activities vary from passive observational activities to physically challenging ones dependent upon the patient’s physical capabilities. Weather patterns as well as available community resources were noted based on statistical data maximizing optimal function and minimizing pain levels for individuals.

Considerations of available community resources such as pools, walking paths (indoor and outdoor) as well as complementary interventions are provided. The community presented is based on general environmental conditions that occur within the OT student’s home community. The resources stated in this project reflect the community of Winona, MN. The winters are generally cold and windy with episodes of snow. Over the course of many years of service provision, numerous statements were continually made regarding the effects of the cold, snow and wind that apparently affected the individuals dealing with arthritis. This is meant to only serve as an example. It is essential that clinicians, who may be interested in adding this perspective to their treatment, modify the resources more specifically to their community.

Various agencies were cited that provide services to benefit an individual whom is experiencing the debilitating effects of arthritis. These agencies are very similar to those offered in most communities in general. Also noted are activities that may enhance function for individuals experiencing difficulties as a result of arthritic changes. These
activities can also be generalized for other communities to encompass benefits in various locations. The community resources were gathered from researching the community chamber of commerce, phone book, and general communication with local residents.

**Organization of the Guidelines for Non-traditional Approaches to Arthritic Treatment & Prevention**

1. For each section the research is summarized and presented so the OT has the most recent and relevant research data available at this point in the development of this project. The OT must realize, of course, that is will become his or her responsibility to remain current and update don’t eh information.

2. The complementary treatment options are listed with examples of environmental and community resources to enhance the traditional approaches to the OT home program.

3. The OT needs to then apply this information to their patient’s community and general weather patterns and integrate their lifestyle and community resources. Currently the guideline is specific to the author’s community as an example. Resources and options in the community must be explored and incorporated by the therapist.

4. Clothing suggestions are provided in relation to weather conditions for optimal skin temperatures during these activities based on the research to minimize pain in the joints.

In Chapter IV, the product will be presented in its entirety.
CHAPTER IV
PRODUCT

Introduction

The purpose of this project was to further research the effects of weather conditions as it relates to the symptoms of the arthritic process. The research resulted in the development of *The Guidelines for Environmental Considerations in Occupational Therapy Home Programs for Arthritis.*

Weather is considered a possible influence on a wide variety of health conditions. Weather conditions can influence activity and independence levels with patients and the guideline considers environmental factors as well as community resources that may complement traditional treatment interventions. At this point, there is no information in occupational therapy that begins to take weather and related environmental factors in consideration. Occupational therapists can utilize local weather conditions advantageously with patients in their daily routines as a guide, to develop more holistic home programming for their clients. It's possibly a new practice approach that deserves to be considered, at minimum, because the patient has the perception that it does play a role and all treatment approaches begin with a theory and then research was gathered and documented to support or refute the theory. Research studies reveal that psychological factors can influence pain responses during functional activities when dealing with arthritis (Gueskens, Burdorf, Evens, Hases, 2008; Peat, 2008; Braun, Lian, Orav, Ohern, Barsky, 2008; Sale, Ginnac, Hawker, 2008).
Theoretical Base

The Model of Human Occupation developed by Dr. Kielhofner (Kramer, Hinojosa, Royeen, 2003). MOHO presents specific reasoning for motivation within an occupation, patterning of the behavior within the roles of the occupation, performance skills needed for the occupation, and environmental influences on the occupation (Kramer et al, 2003).

How to Use the Guide

The Guidelines for Environmental Considerations in Occupational Therapy Home Programs for Arthritis is based on individual lifestyles and environmental conditions for an optimal outcome of pain reduction, improvements in motion, and increased strength as determined by the patient and their therapist. Patients continue to report that weather changes affect their function with daily activities. The research has been inconclusive with specific data in this regard but it does identify two areas more consistently that affect arthritis: barometric pressure and cold weather conditions.

The most influential weather condition noted to impact pain and limitation in function was changes in barometric pressure (Wingstrand, 1990). The research suggested that atmospheric pressure influenced the intra-articular pressure of a joint. The normal joint has an intra-articular pressure that is sub-atmospheric. When intra-articular pressure was equalized to the atmospheric pressure, the joint was more susceptible to subluxation which could lead to pain and further injury (Wingstrand, 1990). The direct effects of atmospheric pressure on joint biomechanics may compromise joint articular cartilage integrity. This may further complicate pain and function.
Research has noted increased pain reports with exposure to moist, humid, cold weather conditions (Patberg, 2004). Decreased intra-articular temperatures resulting from exposure to these cool conditions resulted in decreased functional range of motion in joints, increased pain, and decreased independence in daily activities unless activities were completed for at least 2 hours outdoors (Patberg, 2002).

This guide is designed for the clinician who is interested in combining community based complementary aspects of home program activities with the traditional home program interventions.

1. It is organized in 3 sections
   • Complementary Home Program Treatment Approaches and Considerations
   • Community Resources
   • References
2. Complementary includes a summary of the research so the OT has the most recent and relevant research data available at this point in the development of this project. The OT must realize, of course, that is will become his or her responsibility to remain current and update don't eh information.
3. The complementary treatment options are listed with examples of environmental and community resources to enhance the traditional approaches to the OT home program.
4. Currently the community resources are specific to the author’s community to use as an example. Resources and options in the community must be explored and incorporated by the therapist who chooses to use this guide.
5. Clothing suggestions are made in relation to weather conditions for optimal skin temperatures for several of the activities. The goal is to minimize pain in the joints.
Guidelines for Environmental Considerations in Occupational Therapy Home Programs for Arthritis

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August 2009
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INTRODUCTION

Traditional methods of treatment for arthritis within the realm of occupational therapy have been beneficial for many patients. These treatment methods have been generally effective in the process to minimize pain and improve function in daily activities. However, patients have continued to report pain in functional activities particularly during episodes of weather changes. These increases in pain and functional limitations are often reported during outdoor activities. The research has been inconclusive with specific data in this regard. However, the general principles with environmental conditions can be a factor in the holistic approach utilized with occupational therapy patients. Occupational therapists can utilize local weather conditions advantageously with patients in their daily routines. These factors can be incorporated into the home program and overall treatment patterns used with patients.

Purpose
The intent is to inform occupational therapists about the potential role weather and environmental conditions have in the treatment of arthritic conditions. The research literature confirms that there is a relationship between health and weather. Changes in barometric pressure, humidity, cold temperatures and levels of precipitation have been reported by patients to affect their arthritic symptoms and pain levels (Aikman, 1996; Guedj, 1990; McAlindon, 2007; & Jamison, 1995). Consideration of complementary interventions, incorporated into a traditional home program, needs to occur.

Consideration of the information within the guideline can promote a more holistic approach in the treatment of arthritis within the realm of occupational therapy. Weather conditions can influence activity and independence levels with patients. This guideline can provide alternatives and additional options for treatment of arthritis in addition to the traditional modalities of therapy. Environmental factors are considered as well as community resources that may assist in the functional treatment methods currently utilized in the occupational therapy practice.
Theoretical Base

The Model of Human Occupation developed by Dr. Kielhofner (Kramer, Hinojosa, Royeen, (2003). MOHO presents specific reasoning for motivation within an occupation, patterning of the behavior within the roles of the occupation, performance skills needed for the occupation, and environmental influences on the occupation (Kramer et al, 2003).

This theoretical model utilizes the volitional process involved with participation in an activity. The process includes the anticipation, choosing, experiencing and interpretation of the activity. When working with individuals suffering from the effects of arthritis, this process is magnified when pain is limiting the desired activity.

The outcome changes as the individual experiences pain, particularly when weather conditions impact the choices and availability of activities. Providing creative options of activities within the restrictions of weather and environmental conditions may assist in the volitional choices and positive outcomes for individuals with arthritis.

This theory can also be incorporated into the patient’s processing of success with the available treatment options. Through the use of patient education, the process of understanding the traditional methods of treatment and the nontraditional or complementary, specifically identified approaches within their environmental conditions may improve overall goal attainment.

MOHO suggests that the patient also utilizes experiential learning and problem solving to enhance their outcome and positive end result. Tasks within the
home program involve specific ideas in which the patient can improve pain, motion, etc. using both the traditional and complementary treatment recommendations. These can guide the patient and the therapist in the optimal activities to achieve the goals based on the successes and limitations experienced in the experiences.

**How to Use the Guide**

This guide is designed for the clinician who is interested in combining community based complementary aspects of home program activities with the traditional home program interventions.

1. The complementary treatment options are listed with examples of environmental and community resources to enhance the traditional approaches to the OT home program.

2. It is organized in 3 sections
   - Complementary Home Program Treatment Approaches and Considerations
   - Community Resources
   - References

3. For each section the research is summarized and presented so the OT has the most recent and relevant research data available at this point in the development of this project. The OT must realize, of course, that is will become his or her responsibility to remain current and update the information.

4. Complementary includes a summary of the research so the OT has the most recent and relevant research data available at this point in the development of this project. The OT must realize, of course, that is will become his or her responsibility to remain current and update the information.

5. The complementary treatment options are listed with examples of environmental and community resources to enhance the traditional approaches to the OT home program.

6. The OT needs to then apply this information to their patient’s community and general weather patterns and integrate their lifestyle and community resources. Currently the guideline is specific to the author's community as an example. Resources and options in the community must be explored and incorporated by the therapist.
7. Clothing suggestions are provided in relation to weather conditions for optimal skin temperatures during these activities based on the research to minimize pain in the joints.

8. Currently the community resources are specific to the author’s community to use as an example. Resources and options in the community must be explored and incorporated by the therapist who chooses to use this guide.

Research:

There are more than 100 types of arthritis. The evidence for associations with weather and pain reports is mixed. It is possible that different types of arthritis will respond differently to changes in barometric pressure and related weather conditions.

Although research on the topic of pain and its relationship to changes in weather patterns has conflicting reviews, there is still a significant number of research studies that have confirmed that for many people, weather does affect health. There is mounting evidence that certain health problems are aggravated or even brought on by the weather.

Historically, study results of the effects of barometric pressure, temperature changes, precipitation and humidity have been contradictory. Various studies have been conducted to determine a correlation of different climate variables with an individual’s impression of weather sensitivity and the correlations of pain and climate conditions (Guedj, 1990; Shutty, 1992; Arbor, 1994; Jamison, 1995; Aikman, 1996; Gorin, 1999; Strusburg, 2002). Many of these studies utilized a questionnaire requesting information such as pain levels and sensitivity. Simultaneous weather data was incorporated and utilized to formulate correlations among the items.

Within the past 20 years various studies have found a positive correlation between reported painful arthritis symptoms and changes in the weather (Guedj, 1990;
Studies have been conducted throughout the world to determine the relationships between these factors (Schmidt, 1979; Guedj, 1990; Shutty, 1992; Curkovic, 1993; Arber, 1994; Jamison, 1995; Aikman, 1996; Quick, 1997; Gorin, 1999; Davis, 2003; Wilder, 2003; Sato, 2003; Verges, 2004; Patberg, 2004; McAlindon, 2007; Tsai, 2006).

The discrepancies of results often refer to the differences in information obtained from the subjects within the questionnaires as well as the type of data obtained regarding weather conditions. The studies also found varied data when comparing subject diagnoses such as osteoarthritis and rheumatoid arthritis in reference to reported pain in the weather conditions. Several of these studies are presented in the following section of the literature review progressing from a historic to contemporary research perspective.

**Historic Studies**

Guedj (1990) completed a study in Israel, to identify a positive correlation between pain and barometric pressure, temperature and rain in patients. The patients were diagnosed with various forms of arthritis including osteoarthritis, rheumatoid arthritis, and fibromyalgia. A questionnaire requested information about the severity of joint pain and swelling. It also requested information on their ability to complete activities of daily living using a scoring scale. The information was then compared to statistical weather data to formulate correlations with the pain, swelling and disability levels as related to the weather changes.

It was found that pain was affected positively by temperature, rain and barometric pressure in individuals with osteoarthritis. It also discovered that an
increase in barometric pressure and temperature intensified pain in rheumatoid arthritis. Patients with fibromyalgia reported that changes in the weather pattern aggravated their pain levels. In patients with fibromyalgia, pain was affected by the effects of barometric pressure alone. This study reports that pain in various forms of rheumatic disease can be predicted at a high percentage when one or more of the weather variables are used. This phenomenon is reported by statements of rheumatic patients that believe that they can predict weather changes by their increased joint pain.

Shutty, Condiff & DeGood (1992) completed another study comparing pain with precipitation and temperature. This resulted in a similar conclusion as the Guedj (1990) study that identified a reported increase in pain in association with precipitation and temperature. The Weather and Pain Questionnaire (WPQ) was utilized with a comparison to the weather variables of precipitation and temperature. The results indicated that patients reported increased pain during weather changes in the variables of humidity and temperature. Joint and muscle aches were the most frequently described symptoms during these weather changes. Patients who scored higher than the median, with the WPQ, were defined as “weather sensitive.” These patients reported greater pain intensity, longer time frames of pain problems, and more sleeping deficits than those patients with lower WPQ scores. No specific differences in gender, education level, disability status or general psychological distress were noted within this study. Shutty et al. (1992) concluded that patients could reliably identify which weather variables influenced their pain levels. However, the study did not specify which symptoms would be consistently affected.
Arber (1994) also completed a study in Israel researching the effects of the weather in relation to the initiation of a gouty arthritis episode. The hospital records were reviewed for individuals who experienced an acute gouty arthritis episode. Statistical weather data was then reviewed for each of the episodes with these patients. No specific subjective information was gathered from any patient, rather objective data with the gouty arthritis episode and weather data were compared. Objective medical information, including the presence of elevations in plasma uric acid levels, was obtained from the hospital records. This indicated a gouty episode resulting in the patient visit to the facility. This indicated that an arthritic response had occurred as documented within the gouty episode. This documentation verified the rationale for the visit to the hospital, therefore justified the date for the study. Objective weather data included information of mean day time, and the wet, dry, minimal and maximal temperatures at midnight and 12 noon, the barometric pressure and heat stress (wet temperature + dry temperature divided by two). The weather information was gathered and reviewed for the 5 days that preceded the gouty attack. A positive correlation of specific changes in the weather patterns 5 days prior to the gouty attacks, generally on the fourth and fifth day preceding the attacks. This study revealed that climate changes before a change in the arthritic status may contribute to the acute episode. Therefore, weather conditions may play a role in the pathology of acute gouty arthritis exacerbations.

Historically, the controversy of the effects of weather has also resulted in opponents of the theory of pain resulting from weather changes. One such study that refutes any significance of pain related symptoms related to weather variables was
completed by Jamison, Andersen and Slater (1995) This study consisted of information from participants from San Diego, CA, Nashville, TN, Boston, MA and Worchester, MA. The participants all had chronic pain of which 39 percent were diagnosed with arthritis. This study indicated that the majority of patients with chronic pain perceive this pain to be related to weather changes. However, there were no clear demographic variables or geographic regions that explained the weather sensitivity. This study did not find a correlation between reports of pain and weather conditions.

Jamison, et al (1995) indicated that the two most predictable factors for weather sensitivity included age and patient belief that they had the diagnosis of arthritis. Younger individuals tended to report pain sensitivity to weather changes. The reasoning for decreased frequency for older patients to report pain sensitivity is unclear. In this study it was uncertain if older individuals were less inclined to admit to weather sensitivity due to generalized decreased sensitivity or whether they are less bothered by changes in weather and climate changes.

In Bendigo, Australia, Aikman (1996) conducted a study to determine if there was a relationship between the pain and rigidity of arthritis and the weather variables of temperature, relative humidity, barometric pressure, wind speed and precipitation. Data was collected via a questionnaire with simultaneous statistics for the weather conditions. The subjects of the study included patients diagnosed with either rheumatoid arthritis or osteoarthritis. The results indicated that participants demonstrated an inverse relationship between temperature and symptoms. They also displayed a positive relationship from symptoms and relative humidity. Therefore this
study reported an association between symptoms of arthritis and actual weather variables. Temperature, relative humidity and time of day, respectively, were the most significant factors affecting the pain and rigidity symptoms. Wind speed did not seem to be a factor in the description of symptoms. The results clearly indicated that pain and rigidity are significantly influenced by low temperatures and high relative humidity.

Gorin (1999) indicated a slight difference in pain perceptions with comparisons to weather variables including barometric pressure, relative humidity, temperature and hours of sunlight. The study found that pain severity levels increased during periods of cold weather with diminished sunlight. It also noted increased pain levels with high barometric pressures and daily changes of relative humidity. This study did state that the magnitude of these associations were rather trivial and did not indicate a significant weather to pain association. This study also suggested continued studies to include psychological factors within the factors of pain and weather change associations.

In Argentina, Strusberg, Mendelberg, Serra, & Strusberg (2002) attempted to find a correlation between climate variables and patient reported impressions of weather sensitivity. The focus was on the 5 days preceding and following a painful arthritic episode. Each weather related factor was evaluated separately in this study. Patients reported a higher pain level with low temperatures and high humidity levels. The control group did not demonstrate a significant correlation. The results supported the theory that weather conditions do influence rheumatic pain, however, the results varied with diagnoses and weather sensitivity levels. The study concluded that
patients with rheumatoid arthritis reported that pain was reflected negatively by temperature and positively by humidity and barometric pressure (Strusberg, 2002)

The significance of these historic studies is that people have reported an increase in pain in association with weather changes for numerous years. As data and technology has improved, researchers continue to research methods to address the concerns. Although technological advances have been made as the years have passed, variables continue with the type of data collected. More modern studies have tried to obtain objective data for these concerns and these more contemporary studies will be presented in the following.

**Contemporary Studies**

More recently, research has been conducted to provide additional support to the theory that changes in weather patterns affect pain levels with patients. Takahashi (2003) used controlled rats to determine if cold temperatures induced pain. The focus was to determine if there was a positive correlation between the facilitation of primary nerve fibers and cold hypersensitivity in chronically inflamed conditions. The results showed a positive correlation between decreases in temperature and nerve fiber stimulation from the nerves responsible for pain. It suggested that cold responses were increased in inflamed rats and the proportion of responses increased in the inflamed rats as compared to the control rats.

Sato (2003) also used rats to determine the effects of barometric pressure on pain responses. Arthritic rats were exposed to low barometric pressure (20 mmHg below the natural atmospheric pressure) and low ambient temperature (7 degrees cooler than the control rats). The results indicated an increase in the number of hind
paw withdrawals in response to noxious mechanical stimulation. The number of paw
lifts in response to the noxious mechanical stimuli increased with the rats that were
given a complete Freund's adjuvant solution (CFA) injection. The results of this study
indicated that lowering the barometric pressure and ambient temperatures, within the
range of natural environmental fluctuation, intensifies pain in arthritic rats. The control
rats were not affected by these changes.

Wilder (2003) reported that overall they did not find evidence that weather is
associated with pain. However, this study did find that women experience a
relationship between weather and pain. These same results were not as strong when
comparing men and the relationship between weather and pain. The study found that
women, with osteoarthritis in their hands, had higher pain levels were scored during
days of rising barometric pressure.

Verges (2004) reported evidence that individuals with osteoarthritis experience
increased joint pain with a decrease in barometric pressure. Verges (2004) also
indicated that meteorological variables affect pain in individuals with rheumatoid
arthritis as well. This study suggested that low atmospheric pressure and low
temperature increases the risk of joint pain. The results strongly support the
relationship of weather on joint pain in individuals with osteoarthritis.

Patberg (2004) completed a literature review of the effects of weather on
reported increased symptoms of arthritis. Patberg (2004) found a relationship between
the time spent outdoors and the symptoms of RA. He found that temperature and
humidity influence rheumatoid arthritis variables such as pain, stiffness and
erthrocyte sedimentation rate (ESR). Other weather variables were more
controversial in correlations with these symptoms and weather conditions. He referenced the phrase “cold and wet is bad, warm and dry is good for RA patients” to be true for humidity (Patberg, 2004, p.1334). Pathberg (2004) found that outdoor exposure was beneficial to individuals with RA. Humidity was also influenced by the evaporation from the skin. The choice of clothing was paramount in contributing to the body’s ability to allow ventilation over the skin. This factor then contributed to the humidity level directly over the skin which influences the symptoms of RA.

This study stated that with an increase in successive days in the cold, pain decreased. When a person was exposed to low outdoor temperatures and wore light clothing, an increase in pain was reported. The study stated that staying outdoors for 2 or more hours on days warmer than 6 degrees Celsius (42.8 degrees Fahrenheit) resulted in minimal changes in pain. Being outdoors on cool days briefly also had minimal effects on pain. Individuals spending more than 2 hours outdoors reported their pain to decrease. In fact, the longer the period of successive days of cold, the greater the decrease in pain (Patberg, 2002).

A cool outdoor temperature as well as being outdoors will have a cooling affect on the skin and joints (Patberg, 2002). In general, the most frequently reported experience from individuals in the study was the sense of feeling chilly while wearing light clothing during light outdoor activities.

The main point stressed in the Pathberg (2004) article was the statement that being outdoors for 3 or more hours per day appears to have a beneficial effect on rheumatoid arthritis. Study participants who were outdoors for 3 or more hours per day in the cool temperatures reported decreased pain (Patberg, 2002). It is uncertain if
this was due to vasoconstriction or an increase in cortisol (Patberg, 2002). A high level of cortisol increases blood pressure and blood sugar which results in decreased immune responses (Wein, 2003). The lowered immune response can result in arthritic flare-ups (Wein, 2003). However, decreased cortisol levels result in vasodilation, which may influence muscle relaxation and pain relief (Wein, 2003).

McAlindon, Formica, Schmid & Fletcher (2007), found that both changes in barometric pressure and ambient temperature directly influenced patient reports of pain severity levels. It reported consistent findings throughout various geographical locations and during various periods of time over the course of the study. Evidence indicates that an increase in barometric pressure and ambient temperature change resulted in an increase in pain severity. A change in pain level was consistently reported with a 10 degree decrease in temperature. Thus, an explanation was provided related to the temperature differences from indoors and outdoors. If an individual remains indoors during extremes of temperatures, this may limit the exposure of this effect. During cold weather, the pain effect may only manifest itself with those individuals who venture outdoors.

A positive correlation between pain symptoms and temperature changes was documented by Tsai (2006). In this study, individuals with the diagnosis of juvenile rheumatoid arthritis were requested to keep records of pain symptoms. These records were then compared to weather conditions such as barometric pressure, temperature, and humidity levels. They found that pain symptoms increased the day after the advent of a cold wave. The reports of joint swelling were not related to weather conditions.
conditions. This study concluded that weather changes, such as the onset of a cold wave, may influence the experience of joint pain.

McAlindon et al (2007) referenced a study by Wingstrand (1990) that suggested that atmospheric pressure influenced the intraarticular pressure of a joint. The Wingstrand (1990) study suggested that a normal joint has an intraarticular pressure that is subatmospheric. When the intraarticular pressure was equalized to the atmospheric pressure, an increase in subluxation of the joint was noted. This suggests that the direct affects of atmospheric pressure, on joint biomechanics, play an additional role on joints that may be compromised via surgical joint replacements or generalized compromised joint articular cartilage integrity. This may further complicate the pain factors when considering changes in weather temperature and barometric pressures.

The research is inconclusive as to the degree of a consistent relationship between weather conditions but over 50% of the research data does indicate a relationship. The classic clinical descriptors' regarding arthritis has been presented. In addition, the research on a possible correlation between arthritic symptoms and the weather has been explored and described but what does this all mean to the patient's quality of life?

Pain, or the perception of pain, in relation to changes in weather and environmental conditions, directly affects many individual’s ability to perform functional daily living activities if not physically at minimum psychologically. Research studies have also revealed that psychological factors can influence pain responses during functional activities when dealing with arthritis (Gueskens, Burdorf,
Evens, Hases, 2008; Peat, 2008; Braun, Lian, Orav, Ohern, Barsky, 2008; Sale, Ginnac, Hawker, 2008). Even if it is a matter of perception “there is a potentially important message in the connection many people notice between the weather and their arthritis. Understanding this better could lead to improved understanding in why arthritis develops and how better to treat it” (Shmerling, 2009, p. 2).
Introduction to Section:

The complementary interventions listed in this guideline are based upon data retrieved from the literature review as related to environmental conditions. The term complementary is used since these interventions are not considered traditional forms of practice supported by conclusive research data. Therefore, their purpose is to complement the traditional forms of interventions typically used in home program development.

This information was then expanded to include functional activities within those environmental conditions. Information in regard to weather patterns was incorporated into the guideline to further expand on home program techniques to enhance the function of the patient. Various weather conditions, particularly barometric pressure changes, may influence pain levels in patients during functional activities outdoors. Choices of activities within the home program, based on the patient’s environment, may impact the optimal outcome of the home program.

The adaptations presented in this guideline are intended to enhance the traditional methods of treatment with the provision of activities within the individual’s community. The therapist is encouraged to continue to utilize commonly used modalities and treatment options for their patients. These commonly used treatment options are necessary to minimize pain and joint damage. Additional suggestions for modifications with a home program are provided within this guideline. For example, if a desired activity is chosen for a home program, clothing suggestions may enhance the optimal pain relief during that particular activity based on the weather conditions for the individual on that particular day.

How to Use the Information in Relation to Complementary Interventions:

The utilization of both traditional and complementary interventions may optimize the outcomes for patients with arthritis. The traditional modalities and options provide proven pain relief for arthritis patients. The utilization of the complementary options may further enhance this level of pain relief based upon the information noted in the research with increased symptoms in relation to weather changes. These complementary
approaches would act as an adjunct to the general or traditional treatment methods to further minimize pain and optimize function in daily activities.

The complementary activities, listed in this guideline, are based upon data retrieved from the literature review in relation to environmental conditions. This information was then expanded to include functional activities that can be beneficial within those environmental conditions. Consideration of the individual’s community resources and weather patterns will impact the choices utilized in the complementary intervention section.

Use of this guideline may minimize the pain experienced within outdoor settings. It may also be utilized as a prevention module for further injury that could occur if an individual experienced joint instability. The utilization of protective devices on joints during outdoor activities may minimize further joint destruction and damage resulting in decreased pain and complications in the disease process. Managing the temperatures of the joints by wearing suggested clothing when outdoors may also assist in this process.

Interesting Related Websites:

- Aches & Pains by The Weather Channel Your daily forecast for better health. Get your local Aches & Pains forecast for your area by inserting your city and zip code. Available at: http://www.weather.com/activities/health/achesandpains/
- The German weather service has developed a weather-health index, which predicts the degree of risk of particular ailments across the country. The program began in 1985 and by 1994 they were producing weather-based health forecasts which are aired alongside the weather forecasts. Physicians in Germany have indicated that the bio-weather forecasts are very useful during consultations with their patients. Currently this website is only in German.
- In the United Kingdom, they have applied this knowledge in a slightly different manner. During the 2000-2001 winter season, the meteorological office and the department of health conducted a pilot study forecasting hospital workload based on the probability of increased incidences of heart attacks, respiratory difficulties, falls and broken bones linked to the weather. During a two-week period which forecasted a slower than normal workload, one hospital was able to schedule an additional 150 elective surgeries at a savings of $1.2 million.
- A computer-generated, weather-health map of North America has been developed as a prototype. It combines weather factors known to affect health such as temperature, humidity, atmospheric pressure and wind. The MediClim™ is an index which defines 14 different weather conditions linked to health ailments. Work is continuing to bring this prototype into the public domain.
LOW BAROMETRIC PRESSURE:
OUTDOOR ACTIVITIES

Supporting Research:

The most influential weather condition noted to impact pain and limitation in function was changes in barometric (atmospheric) pressure (Wingstrand, 1990). The research suggested that atmospheric pressure influenced the intra-articular pressure of a joint. The normal joint has an intra-articular pressure that is sub-atmospheric. When intra-articular pressure was equalized to the atmospheric pressure, the joint was more susceptible to subluxation which could lead to pain and further injury (Wingstrand, 1990). The direct effects of atmospheric pressure on joint biomechanics may compromise joint articular cartilage integrity. This may further complicate pain and function.

High barometric pressure is common near the sea as there is more air above you to place pressure on the ground below (Thomas, 2004). This results in more stabilization on an individual’s joints. Generally, high barometric pressures are associated with hot, clear, summer days (Thomas, 2004). However these increases in heat can promote changes in the barometric pressure. With increased heat, the barometric pressure decreases, resulting in a more unstable weather pattern. The lower pressures lead to fog, frost, and clouds (Thomas, 2004).

High barometric pressures are generally associated with light, weaker winds as well (Thomas, 2004). These lower wind levels tend to have a stabilizing effect on the joint capsular integrity versus high winds which have reportedly been a factor in increased pain (Wingstrand, 1990).

Increased intra-articular temperatures from warm weather conditions resulted in improved functional active range of motion in joints, decreased pain, and general improved functional independence in daily tasks (Wingstrand, 1990). The utilization of the adaptations listed below may influence the desired changes in the intra-articular temperatures and pressures during functional activities.
General Home Program
Intervention Recommendations

1. If the individual plans to stay outdoors briefly (less than 2 hours) – wear heavier clothing and gloves in cool temperatures (42.8 degrees F. or above – to comfort level) to sustain the joint temperature and intra-articular pressure experienced when indoors.

2. If the individual plans to stay outdoors for longer durations (2 or more hours at a time) in cool temperatures (42.8 degrees F. or above to comfort level) – wear lighter clothing to allow intra-articular change to occur – as tolerated.

3. Encourage the use of even surfaces if intra-articular pressure is equalized to the atmospheric pressure which may occur if the individual is exposed to the outdoors for longer durations (2 or more hours) during low barometric pressure conditions to minimize risks of joint injuries:
   a. an increase in subluxation in the joint has been noted in the research.
   b. uncertain of how to determine a “safe” time frame – limited data and evidence.

4. Wear clothing with little to no ventilation during episodes of intended brief episodes outdoors (less than 2 hours) during cool temperatures (42.8 degrees or above – to comfort level) to sustain warm intra-articular temperatures and pressures.

5. Wear clothing allowing full ventilation and air exchange during episodes of longer duration (2 or more hours at a time) in cool temperatures (42.8 degrees F. or above to comfort level – as tolerated).

6. Wear supportive, stable, low heeled shoes to minimize risk of falls and joint instability during planned episodes of outdoor activities.

7. Consider use of soft, supportive braces on joints – knees, ankles, etc. during episodes of walking on uneven surfaces and increased elevations.

8. Consider use of soft, supportive braces on joints – elbows, wrists, hands etc. during episodes of resistance, pushing, pulling to minimize risk of strain and subluxation.

9. Encourage slow, steady stretching prior to outdoor activities to minimize stress on ligaments, muscles, etc.

10. Encourage healthy sleep patterns, rests and a healthy diet to maximize the body’s immune system, thus decreasing the potential for “flare-ups”.

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Activities:
Low Barometric Pressure Conditions
with Cool Temperatures

Listed below are choices of activities within the Winona, MN community. As the OT, please research your patient’s community to identify specific community resources your patients can access. Activities in Winona, MN are presented to give you an idea of the guidelines application.

- These activities are encouraged for individuals experiencing arthritis in the context that the individual is comfortable and experiencing minimal pain.
- These activities are recommended to be trialed in small increments of time to determine the individual’s tolerance level.
- The activities are recommended to be discontinued with any increases in pain or discomfort. They are intended as an adjunct to the home program allowing a variety of choices for the local community member.

1. Walking on outdoor walking path –
   a. preferably completed on smooth, groomed or paved trails with minimal hills and changes in elevation –
   b. distances need to be determined individually based on individual tolerance, comfort and pain levels
   c. no specific data available to specify recommended distances
   d. recommend monitoring the individual’s pain levels following each activity attempt allowing the individual to provide input into the home program

<table>
<thead>
<tr>
<th>Aghaming Park and Reserve</th>
<th>Garvin Heights Overlook &amp; Park</th>
<th>La Canne Park</th>
<th>Lake Park (Veteran’s Memorial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latsch Island Park</td>
<td>Levee Park – Prairie Island Loop</td>
<td>Prairie Island Deer Park</td>
<td>Windom Park</td>
</tr>
<tr>
<td>Bluffside Park Trails</td>
<td>Beaver Creek State Park</td>
<td>Holzinger Lodge &amp; Trail</td>
<td>Highway 43 – Gilmore Valley Loop</td>
</tr>
<tr>
<td>Lake Winona</td>
<td>Great River Bluffs State Park</td>
<td>Great River State Trails</td>
<td>Harmony – Preston Valley State Trail</td>
</tr>
<tr>
<td>John A. Latsch State Park</td>
<td>Quarry Trail</td>
<td>Perrot State Park</td>
<td>Saint Mary’s University</td>
</tr>
<tr>
<td>Root River State Trail</td>
<td>Snake Creek Trail</td>
<td>Wildwood Trail</td>
<td>Trempealeau River Loop</td>
</tr>
</tbody>
</table>
General Tips Related to any form of Golfing
Playing golf can enhance the strength and mobility of the upper extremities, spine, hips and lower extremities. Golf can help range of motion in the joints and help improve balance and coordination.

- Be sure the patient knows to warm-up before they head for any type of course.
- If the weather is damp or chilly, the person might consider taking a hot shower just prior to their tee time. By doing so, their muscles and joints will be their most flexible.
- Check into devices like wrist or knee braces and gloves that are made especially for people with arthritis. Many of them take the pressure off of the joints which makes it much easier to play the game.
- Try stretching exercises. With feet apart the same distance as the shoulders, first rotate the body to the right with the arms hanging free, then rotate the body to the left. Do this ten times in each direction. At the end of this exercise, the patient should notice that they can move farther in each direction than you did before doing them.

2. Disc golfing
   a. Do on a well groomed course with minimal changes in the ground elevation
   b. make sure park benches are available for alternations in positioning and rest periods

<table>
<thead>
<tr>
<th>Lake Park</th>
<th>Saint Mary’s University</th>
<th>Source: Official Visitors’ Guide, 2009</th>
</tr>
</thead>
</table>

3. Mini golfing
   a. typically completed on minimal elevations variances for short distances minimizing the risk of subluxation or stress on joint structures

<table>
<thead>
<tr>
<th>Lake Park</th>
<th>Saint Mary’s University</th>
<th>Source: Official Visitors’ Guide, 2009</th>
</tr>
</thead>
</table>

4. Golfing
   a. use golf cart for long distance walking as needed
   b. to minimize fatigue levels and availability of positional changes and during rest periods
   c. golf cart also minimizes stress of joint instability upon golf course ground variance
   d. recommend utilization of comfortable, supportive shoes allowing adequate flexibility in ankle and foot for correct gait patterning
   e. many of these golf courses offer indoor refreshment facilities to minimize fatigue levels
   f. Use a lower compression ball (for example, a 90 instead of a 100) so there is more “give” to the ball when its hit.
g. Use clubs with lightweight graphite shafts to help absorb shock better.
h. Use a perimeter-weighted head on the club, also for better shock absorption.
i. Build up the grip size on the clubs with athletic tape or a custom grip to help hold them easier and to reduce stress and pain on finger joints.
j. For the hands, try wearing wrist braces and gloves on both hands to stabilize the joints.
k. Wear comfortable walking shoes or spikeless golf shoes.

5. Biking
   a. using well groomed or paved trails with minimal hills or changes in elevation
   b. recommend the utilization of soft, padded handlebar covers to minimize joint stress in the grasping pattern
   c. recommend minimal elevation changes to minimize stress in the efforts of the lower extremities during inclines and hands when braking
   d. recommend bicycle with upright handlebars for optimal back comfort
   e. Handlebars that are too low can cause a stiff neck and low back pain.
   f. Calf muscles and hamstrings must be stretched before and after riding, or they will shorten up in time.
   g. Y-shaped handlebars, known as riser bars, let the person sit taller, reducing strain from leaning forward and a wide handlebar grip, such as Ergon bike grips (www.ergon-bike.com) provides a more even distribution of pressure across the width of the hands.
   h. Helmets are a necessity.
   i. Gloves protect the hands, help reduce vibration and prevent sweaty hands from slipping. Try gloves infused with carbon or gel for maximum protection, such as Pearl’s Pittard ($35, www.pearlizumi.com).
   j. For feet, a lightweight, flexible hiking shoe is better bicycling wear than a flimsy or stiff gym shoe. Feet also benefit from larger pedals, which require the person to exert fewer pounds per square inch for propulsion.
   k. A small rear-view mirror, mounted to your helmet, the bow of your eyeglasses or your handlebars, can help the person avoid accidents by giving both side and rear views without having to turn their head.
   l. Wider wheels absorb more of the jarring from bumps and holes in the road, but narrow wheels require the person to expend less energy to propel the bike. A happy medium, such as a 1½-inch tire, is best.
   m. Front fork and seat post suspension – like those featured on a number of mountain bikes – can significantly reduce shock from bumps, so the joints don’t have to.
   n. a gender-specific, gel-padded bike seat, known as a saddle in cycling circles. Saddles with a notch forged in the center reduce pressure.
6. Bird watching
   a. recommend alternations of sitting and standing to vary the positional changes of the joints
   b. grounds typically have minimal variance in elevations to minimize efforts with walking resulting in minimal joint stress
   c. recommend the utilization of stable, supportive shoes allowing flexibility for optimal ankle and foot gait patterning

7. Canoeing
   a. utilizing periods of rest and changes of positioning by allowing one to dock on the bank for positional change needs
   b. recommend activity during calm days to minimize upper extremity strain and effort in movement patterns when needing to oar the boat
   c. recommend the utilization of gloves with the oars for joint protection and maximal grip
   d. recommend alternations of upper extremity use when paddling for optimal energy conservation and fatigue management
### Fishing

<table>
<thead>
<tr>
<th>Beaver Creek State Park</th>
<th>Lake Winona</th>
<th>Latsch Island – Aghaming Park</th>
<th>Levee Park – Prairie Island Loop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mertes Harbor</td>
<td>Prairie Island</td>
<td>Root River State Trail</td>
<td>Whitewater State Park</td>
</tr>
</tbody>
</table>


### Horseback Riding


Activities to Enhance Extensibility of Collagen Connective Tissue

1. Swimming
   a. buoyancy of the water sustains desired joint pressure gradient (Wingstrand, 1990)
   b. promotes optimal range of motion and strengthening with minimal pain (Hunter, 2000)
   c. recommend swimming for short durations initially to determine pain levels following activity
   d. recommend wading in water if swimming is too difficult
   e. extremely hot water is not safe and is not necessary to get results; mild heat is just as effective and easier for the body to tolerate. The tem should feel soothing and comfortable with temperatures ranging from 83 – 88 degrees.
   f. Start slowly, extend time as you feel comfortable.
   g. Consider that the patient may need help getting in and out of the pool so it may be good to ensure a lifeguard is on duty and rails are available for ease in exiting the pool.
   h. Flotation devices may be considered

<table>
<thead>
<tr>
<th>YMCA</th>
<th>Local hotels</th>
<th>Source: Official Visitors' Guide, 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local University Pools</td>
<td></td>
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</tbody>
</table>

2. Range of motion and stretching programs
   a. recommend involvement in classes offered for individuals with arthritis
   b. recommend minimal resistance / weights during exercises to minimize joint stress particularly during initial phases of program
   c. most of the activities presented in this guideline involve the patient working on range of motion.
   d. Ensure the patient understands clearly their limits and either you should guide them once on the equipment in the facility they choose or contact should be made with fitness trainer.

<table>
<thead>
<tr>
<th>YMCA</th>
<th>Snap Fitness</th>
<th>Anytime Fitness</th>
<th>Boardwalk on Third</th>
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Activities to Enhance Anti-phlogistic Effects in Chronic Inflammations

1. recommend short durations of activity initially to determine pain response and tolerance
2. recommend utilization of existing programs for individuals experiencing arthritis

<table>
<thead>
<tr>
<th>Swimming and exercise programs at the YMCA</th>
<th>Local University pools</th>
<th>Hotel pools</th>
<th>Boardwalk on Third</th>
</tr>
</thead>
</table>

Research Considerations

Research has noted increased pain reports with exposure to moist, humid, cold weather conditions (Patberg, 2004). Decreased intra-articular temperatures resulting from exposure to these cool conditions resulted in decreased functional range of motion in joints, increased pain, and decreased independence in daily activities unless activities were completed for at least 2 hours outdoors (Patberg, 2002).

The weather patterns that typically create cold and wet conditions are related to low barometric pressures (Thomas, 2004). The low pressures combined with cool temperatures results in water condensation and cloud formation. This often results in rain, snow or sleet (Thomas, 2004). These types of conditions are the ones most frequently reported as being the most painful and debilitating by patients (Patberg, 2002). The barometric pressure is fluctuating which may create fluctuations in intra-articular joint pressures (Wingstrand, 1990). This results in pain and instability of the joint capsule and structures within the joint.

Many patients may be unable to tolerate the recommended 2 hour duration outdoors in these temperatures to allow the pressure gradient changes. Therefore, it is recommended that activities be completed indoors during weather conditions consisting of cool temperatures with excess humidity and low barometric pressures.
Indoor Activities to Increase/ modulate Intra-capsular Temperature

1. most beneficial with duration of 2 or more hours indoors in temperatures warmer than 6 degrees C. (42.8 degrees F.)
2. Walking on indoor paths – with even pavement or flooring

<table>
<thead>
<tr>
<th>Winona Mall</th>
<th>YMCA walking Path</th>
<th>Arches Museum of Pioneer Life</th>
<th>African Safari Museum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bunnell House</td>
<td>Minnesota Marine Art Museum</td>
<td>Pickwick Mill</td>
<td>Polish Cultural Institute</td>
</tr>
<tr>
<td>Rollingstone-Luxembourg Historical Museum</td>
<td>Watkins Heritage Museum &amp; Store</td>
<td>Winona County Historical Society Museum</td>
<td>Visitation to the local library – available options of alternations of sitting and standing</td>
</tr>
</tbody>
</table>

Outdoor Activities to Increase / modulate Intra-capsular Temperature

- most beneficial with duration of 2 or more hours of outdoor in temperatures warmer than 6 degrees C
- with utilization of well ventilated clothing to minimize the accumulation of moisture within the clothing which can create additional pain concerns (Patberg, 2004)
• these activities should only be recommended if the patient is familiar with the activity and has previous experience with the activity to minimize risks of further injury due to falls and accidents
• recommend these activities only if the patient is able to tolerate the temperatures and weather conditions for more than 2 hours
• recommend use of light clothing around the affected joints with maximal ventilation to allow the exchange of intra-articular pressure changes (Patberg, 2002 and Wingstrand, 1990)

a. recommend use of padded gloves to minimize joint stress while gripping on the handlebars

<table>
<thead>
<tr>
<th>Trout Valley Unit Trails</th>
<th>Corridor Trails</th>
<th>Corridor 70 Trails</th>
<th>Zumbrowath – Wabsha Trails</th>
</tr>
</thead>
</table>

2. Cross country skiing (Official Visitors’ Guide, 2009) – recommend use of padded gloves to grip the ski poles minimizing joint stress – recommend use of rest periods along the trails to minimize fatigue –

<table>
<thead>
<tr>
<th>Holzinger Lodge and Trail</th>
<th>Great River Bluffs State Park</th>
<th>Prairie Island</th>
<th>Saint Mary’s University</th>
</tr>
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</table>
COMMUNITY RESOURCES FOR TRADITIONAL TREATMENT OPTIONS

The local community offers resources for individuals seeking traditional treatment options. These facilities offer the traditional approaches for the treatment of arthritis including employment of occupational therapists. Other local facilities offer general guidance with exercise programs including specific programs for individuals with arthritis. These agencies also offer an opportunity for socialization as well as continued connections with others experiencing the effects of arthritis.

1. Health centers with available therapy for traditional approaches as well as integrated alternatives

<table>
<thead>
<tr>
<th>Community Memorial Hospital</th>
<th>Franciscan Skemp Healthcare</th>
<th>Gundersen Lutheran Hospital</th>
<th>Gundersen Lutheran Sports Medicine - Winona</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saint Anne of Winona Rehabilitation Services</td>
<td>Sport and Spine Physical Therapy Inc. of Winona</td>
<td>Therapy Network Inc.</td>
<td>Winona Health Rehabilitation Services</td>
</tr>
</tbody>
</table>

2. Local community facilities offering available opportunities for light exercises and guided arthritis exercise programs

<table>
<thead>
<tr>
<th>Boardwalk on Third</th>
<th>YMCA</th>
<th>Snap Fitness</th>
<th>Anytime Fitness</th>
</tr>
</thead>
</table>

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Takahashi, K., Sato, J., & Mizumura, K. (2003). Response of c-fiber low threshold mechanoreceptors and nociceptors to cold were facilitated in rats persistently inflamed and hypersensitive to cold. Neuroscience Research, 47, 409-419.


CHAPTER V
SUMMARY

The purpose of this scholarly project was to further research the effects of weather conditions as it relates to the symptoms of the arthritic process. The intent is to inform occupational therapists about the potential role weather and environmental conditions have in the treatment of arthritic conditions. The research literature confirms that there is a relationship between health and weather. Consideration of complementary interventions, incorporated into a traditional home program, needs to occur to ensure a holistic approach.

This project allowed for the exploration and consideration of the relationship of weather changes into home program treatment options using complementary interventions. It is hoped that the combination of traditional and complementary can minimize the symptoms reported with this disease process. Treatment generally focuses on the symptoms and limitations that the disease process targets within the exacerbation period. Minimal focus has been provided to the circumstances within each individual’s environment and lifestyle for provision of treatment.

A literature was conducted and resulted in the development of a guide that provides traditional and complementary interventions while considering the general weather patterns reported to have an impact arthritic changes. Occupational Therapists (OTs) can use this as a guide, based on their local general environmental conditions and
develop a comprehensive home program. The complementary interventions are related to the general weather patterns and community resources. Community resources may include swimming pools, indoor vs. outdoor walking paths or YMCAs. The community resources are incorporated into the preventative treatment program to minimize the destructive disease process. Regardless of specific data available, individuals continue to report changes in their ability to function during these episodes.

Although the research for the topic of pain and its relation to changes in weather patterns has conflicting reviews, patients continue to frequently report changes in their function during these times. Pain, or perception of pain, in relation to changes in weather and environmental conditions, directly affects many individual’s ability to perform functional daily living activities. Research studies have also revealed that psychological factors can influence pain responses during functional activities when dealing with arthritis (Gueskens, Burdorf, Evens, Hases, 2008; Peat, 2008; Braun, Lian, Orav, Ohern, Barsky, 2008; Sale, Ginnac, Hawker, 2008). So even though there are conflicting results in the research there still is supporting data in over 50% of the research reviewed. This is significant enough to still consider the role of weather as a contributing factor. Complementary therapies do not have the same level of research outcomes to support their application as traditional therapies but that does not diminish the possibilities of positive influences by complementary interventions when combined with traditional.

The Guidelines for Environmental Considerations in Occupational Therapy Home Programs for Arthritis was developed to provide ideas for the clinician regarding complementary treatment ideas in conjunction with traditional home program methods. These complementary treatment ideas are based on consideration of weather patterns that
are reported often by patents to impact arthritic changes. Occupational Therapists can use this as a guide to help patients make decisions on home program activities, based on their environmental weather conditions, to enhance their daily lives.

**Limitations of the Project**

Research in this area is very difficult to conduct due to many of the reasons presented in the following.

1. The guideline has not been piloted or reviewed to assess its effectiveness or usefulness.
2. Study results of the effects of barometric pressure, temperature changes, precipitation and humidity have been contradictory.
3. Within the past 20 years various studies have found a positive correlation between reported painful arthritis symptoms and changes in the weather (Aikman, 1996, Guedj, 1990, Arbor, 1994, Shutty, 1992, Strusberg, 2002).
4. There are more than 100 types of arthritis so it is possible that different types of arthritis will respond differently to changes in the barometric pressure.
5. The severity of arthritis varies over a wide range. It is possible that mild arthritis will improve in certain circumstances while severe arthritis might respond differently in those same conditions (Shmerling, 2009).
6. The relationship between barometric pressure and arthritis may be affected by age, medications and other health issues. Teasing out these factors from changes in the weather is not easy (Shmerling, 2009).
7. A person's psychological state can affect the perception of pain. Changes in weather or barometric pressure could have an impact on arthritis pain by their effects on psychological health, rather than a direct effect of weather.
8. Lastly, the guideline has limitations as it is based on opportunities within a community in Minnesota. However, the basis for the activities can be generalized to other communities.

**Proposal for how the Project could be Implemented**

It is hoped that the guidelines are used by clinicians in several ways:

1. The product is a guideline of options for occupational therapy to consider when advising patients in home programs that are based on individual lifestyles and environmental conditions for an optimal outcome to reduce pain, limitations in motion, and decreased strength.
2. To the design home programs that incorporates the patients perspective that there is a correlation between weather and arthritic pain and help the patient design community activities, within their lifestyle, that meets the goals of the home program and patient.
3. To begin to look at the validity of the influence of weather and arthritic pain through the research and continue to stay informed of new and upcoming research.
4. To possibly consider designing their own small research studies or case studies in regard to this topic that they can contribute to the larger body of knowledge.
5. To expand home program interventions beyond the biomechanical and medical model and incorporate more occupation based activities.
6. This guideline is intended to be utilized in conjunction with the traditional modalities of treatment currently utilized to maximize function and minimize pain for those dealing with arthritis.

Recommendations for Future Action, Development, or Research

Additional research is necessary to obtain a clear and consistent correlation to direct environmental effects on the joint capsule of individuals with arthritis. Yet with one considers that there are over 100 forms of arthritis we cannot wait until all of the research is conclusive to see the extent of a relationship. Much of the research does support this notion. Use of traditional treatment interventions is still essential especially those that show clear outcomes but combining these with complementary interventions seems a viable option as well.

1. Additional research needs to occur at all professional levels if treatment patients diagnosed with arthritis. This includes OT’s who have not historically been actively engaged in research.
2. OT research needs to assess the effectiveness of the complementary interventions in conjunction with the traditions, including the psychological factors. Consideration for personal preferences in regard to available indoor and outdoor activities can impact compliance with suggested exercise and activity routines.
3. A template of the guideline could be developed allowing clinicians to ‘fill in the blanks’ to increase ease with home program. Basically a tip sheet or planning sheet the therapist can fill in and send home with patients.
4. The information in the guideline can easily be expanded to include more adaptive equipment and energy conservation ideas.
5. The information in the guideline needs to be updated in regard to the research on weather patterns/conditions and arthritis as it arises.
Conclusions

Pain, or the perception of pain, in relation to changes in weather and environmental conditions, directly affects many individual’s ability to perform functional daily living activities if not physically at minimum psychologically. Even if it is a matter of perception “there is a potentially important message in the connection many people notice between the weather and their arthritis. Understanding this better could lead to improved understanding in why arthritis develops and how better to treat it” (Shmerling, 2009, p. 2).

Weather is considered a possible influence on a wide variety of health conditions. Weather conditions can influence activity and independence levels with patients and the guideline considers environmental factors as well as community resources that may complement traditional treatment interventions. At this point, there is no information in occupational therapy that begins to take weather and related environmental factors in consideration. Occupational therapists can utilize local weather conditions advantageously with patients in their daily routines as a guide, to develop more holistic home programming for their clients. It’s possibly a new practice approach that deserves to be considered, at minimum, because the patient has the perception that it does play a role and all treatment approaches begin with a theory and then research was gathered and documented to support or refute the theory.

The combination of traditional and complementary treatment interventions may enhance the success of pain relief for patients suffering from the debilitating effects of arthritis. The product is a guideline of environmental considerations or complementary
approaches for occupational therapy to consider when designing and advising patients in home programs in conjunction with traditional approaches. The goals of these considerations or approaches are to further minimize the symptoms of arthritis based on the environmental and weather conditions of the community.
REFERENCES


Takahashi, K., Sato, J., & Mizumura, K. (2003). Response of c-fiber low threshold mechanoreceptors and nociceptors to cold were facilitated in rats persistently inflamed and hypersensitive to cold. Neuroscience Research, 47, 409-419.


