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The naturally restorative environment as a nonpharmacological intervention for dementia

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THE NATURALLY RESTORATIVE ENVIRONMENT AS A NONPHARMACOLOGICAL INTERVENTION FOR DEMENTIA

by

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CERTIFICATE OF APPROVAL

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PH.D. THESIS

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This is to certify that the Ph. D. thesis of

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When despair for the world grows in me
and I wake in the night at the least sound
in fear of what my life and my children's lives may be,
I go and lie down where the wood drake
rests in his beauty on the water, and the great heron feeds.
I come into the peace of wild things
who do not tax their lives with forethought
of grief. I come into the presence of still water.
And I feel above me the day-blind stars
waiting with their light. For a time
I rest in the grace of the world, and am free.

Wendell Berry, The Peace of Wild Things

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LIST OF ABBREVIATIONS

Terms & abbreviations

AD= Alzheimer's disease

AT= Aromatherapy

ART= Attention restoration therapy

BEHAVE-AD= Behavioral Pathology in Alzheimer's Disease (Reisberg, Borenstein, Salob, Franssen, & Georgotas, 1987),

BLT= Bright light therapy

BRCS= the Dementia Behavior Rating checklist (Mungas, Weiler, Franzi, & Henry, 1989)

BPSD= behavioral and psychological symptoms

CMAI- Cohen-Mansfield Agitation Inventory (Cohen-Mansfield, & Billig,1986).

CMS= Centers for Medicare and Medicaid Services

CR= Cognitive reserve

DCM= Dementia Care Mapping (Bradford Dementia Group, 1997).

EO= essential oil as used in aromatherapy

GIP= the Gedragsobservatieschaal voor Intramurale Psychogeriatrie (GIP) (Verstraten & van Eekelen, 1988), The GIP measures different types of behavior, including social, cognitive, psychomotor and emotional or affective behavior, and consists of 14 subscales

HT= Horticulture therapy

k= indicates the number of studies

MA= Meta-analysis

NRE= Naturally restorative environment interventions use elements of the earth that are living and animate (such as plants and animals), geographic (land, sea, air, sky), or solar and climatic such as rain, sun, stars, wind and snow that stimulates one or more of the senses, and are done with intentionality for a therapeutic effect (Gibson, Chalfont, Clarke, Torrington, & Sixsmith, 2007).

SCN= The suprachiasmatic nuclei

CHAPTER I

DESCRIPTION OF THE PROBLEM

Introduction

Nature can have a profound effect on people's health, well-being, and quality of life. The healing properties of nature are not a new concept. Naturally restorative environmental (NRE) interventions stimulate one or more of the senses with elements of the earth that are living and animate (such as plants and animals), geographic (land, sea, air, sky), or solar and climatic (rain, sun, stars, wind and snow), and do so intentionality, for a therapeutic effect (Gibson, Chalfont, Clarke, Torrington, & Sixsmith, 2007). Interventions using the NRE can occur indoors or outdoors since they involve sensory stimulation from, or interactive participation with, natural elements.

Environmental psychologists refer to the natural environment as a "rich source of multisensory stimulation" (Kaplan & Kaplan, 1989). NRE interventions come in many forms and stimulate one or more sensory systems. NRE interventions include, for example, aroma therapy, natural light therapy, and horticulture therapy. Interventions that incorporate elements of the NRE have demonstrated a variety of benefits in persons with dementia, including decreased agitation, less psychotropic drug use, and fewer falls (Detweiler, Murphy, Kim, Meyers, & Ashai, 2009; Detweiler, Murphy, Meyers, & Kim, 2008; Hernandez, 2007). Circadian rhythm normalization (sleep patterns and quality), increased socialization, and improved affect, cognitive capacity and attention have also been demonstrated (Colenda, Cohen, McCall, & Rosenquist, 1997; LeGarce, 2002). Self-reported improvement in well-being and quality of life, and engagement in meaningful

activities, are results also noted (Duggan, Blackman, Martyr, & Van Schaik, 2008; Gibson et al., 2007; Heliker, Chadwick, & O'Connell, 2000; Nowak & Davis, 2011).

Results of interventions with persons with dementia that address the impact on the individual (sleep, quality of life, and disruptive behaviors) have been generally positive, though some studies have conflicting or inconclusive results, such as the Cochrane review on light therapy which reported there was inconclusive evidence in findings to recommend it for persons with AD (Forbes et al., 2009). Most of the intervention studies focus on one sensory stimulus, such as light therapy or aromatherapy. In contrast, horticulture therapy may or may not focus on one sensory aspect. Evaluating reports on these stimuli provokes questions regarding methodology, issues with treatment fidelity, and whether the limited effects are due to small sample sizes.

While NRE interventions potentially offer rich benefits for persons with AD, the research to support its use has not been synthesized and defined in terms of specific behaviors that may be affected, dosage, type of NRE, settings, and other specific characteristics, which are needed to develop optimal interventions.

Specific Aims

The purpose of this dissertation is to discuss the comprehensive meta-analysis (MA) of published and unpublished studies that detail the use of NRE in interventions for persons with AD. To guide development of new NRE interventions, for persons with AD, moderator variables were analyzed by meta-regression and the characteristics of various types of programs synthesized.

Meta-analysis can answer specific types of questions: Does this work? How well does it work? When does it work? For whom does it work? How can it best be

implemented? Arguably, this meta-analysis is justified because it evaluated the combined effect sizes, provided a moderator analysis of various types of therapies, and met the need for a published meta-analysis of the topic. The moderator analysis and meta-regression discussed herein include concepts such as the specific type of NRE, setting, and level of AD. Depending on the details of data found in reports, duration and frequency will also be considered. Since, in preliminary review, the type of dementia is frequently not reported in the analysis in a meta-regression model, the specific aims of this dissertation are to:

1. Conduct a meta-analysis of studies that detail the use of NRE interventions with persons with AD, to establish combined effect sizes for impact on agitation, regardless of setting;
2. Conduct a meta-analysis of studies that detail the use of NRE interventions with persons with AD, to establish combined effect sizes for impact on well-being/quality of life, regardless of setting;
3. Conduct moderator analysis evaluating characteristics such as dosage, type of NRE, setting, and, if possible, as level or type of dementia;
4. Prepare three publishable manuscripts:
    a. A literature review of NRE (included as chapter 2). A paper has already been published on horticulture therapy, so an additional manuscript will outline the state of the science for aromatherapy and bright light therapy.
    b. A methodological description and justification for inclusion of more than randomized clinical trials.

c. Findings of the MA studies on whether NRE influences disruptive behaviors and quality of life.

The knowledge that was generated will underpin the trajectory of the investigator's future research by directing individualized NRE interventions for disruptive behaviors that enhance the quality of life for persons with dementia.

Statement of the Problem

Behavioral symptoms of the person with dementia

Alzheimer's disease (AD) is a neurodegenerative disease that affects areas of cognitive capacity, which includes memory, attention, language, personality, and problem solving, depending on which areas of the brain are affected. The disease eventually progresses to neuromuscular involvement, disability, dependence, and death (Aalten, de Vugt, Jaspers, Jolles, & Verhey, 2005; Morris, 2006).

AD is associated with behaviors that can be disturbing and disruptive and often results in a mismatch between environment and needs or excessive stressors (Algase et al., 1996; Hall & Buckwalter, 1987). The International Psychogeriatrics Association has labeled these behaviors "behavioral and psychological symptoms of dementia" or BPSD (Brodaty and Finkel, 2003). Nursing home placement is often due to BPSDs, which occur in nearly every person with the disease at some point during the course of the illness (Lyketsos, Lopez, Jones, Fitzpatrick, Breitner, & DeKosky, 2002). BPSDs account for many negative health outcomes, including declines in functional status, social engagement, and physical activity (Lyketsos, 2007), which increase the cost of care (Murman & Colenda, 2005). BPSDs also negatively affect quality of life and increase caregiver burden (O'Brien, Shomphe, Kavanagh, Raggio, & Caro, 1998).

As AD progresses, the symptoms worsen and the result is often a severely diminished capacity to communicate one's needs and desires, and a loss of self-determination about if, where, and when one goes outside. The result of disease progression is often institutionalization where self-determination is restricted further (Aalten et al., 2005).

Nonpharmacological management for behavioral symptoms

Managing the symptoms of AD and associated BPSDs is complex; and many approaches have been used to intervene (Logsdon, McCurry, & Teri, 2007). These behavior symptoms may be exacerbated or triggered by environmental and/or interpersonal interactions (Logsdon et al., 2007). BPSDs may also be triggered by a diminished capacity for attention, which engenders frustration and errors in accomplishing tasks (Herzog, Chen, & Primeau, 2002; Moore, 2007). The factors precipitating the BPSD are many and are often specific to individuals and individual circumstances.

Studies of non-pharmacological interventions to control BPSD and optimize the health of persons with AD have demonstrated that multimodal sensory stimulation approaches are somewhat effective (Rilely-Doucet, 2009; Schoefield, 2002; Van Deipen, Baillon, Redman, Rooke, Spencer, & Prettyman, 2002; Ward-Smith, Llanque, & Curran, 2009). Moreover, getting to know and understand the patient were shown to be key to discovering underlying variables that trigger BPSDs, allowing those events or situations to be eliminated or minimized. Some strategies described focused on prevention while others focused on the environment or management by medications.

Significance and Justification

In May of 2012, the Centers for Medicare and Medicaid Services (CMS), announced an initiative to "ensure appropriate care and use of antipsychotic medications for nursing home patients" (CMS, May 30, 2012). The initial goal was to reduce antipsychotic drug use to 15% by the end of 2012 (the rate was 23.9), with new goals to be set annually (CMS, May 30, 2012). In addition, CMS adopted newly revised minimum data standards (MDS) for long term care residents requiring "individualized plans of care that include focus on quality of life as well as physical, spiritual, and psychological needs." This means that plans must help the resident reach and maintain the highest practicable level of physical, mental, and psycho-social well-being; this would include services such as social activities, dietary, physician, emergency services, pharmacy, dental, and rehabilitative services (www.CMS.gov, 2012).

NREs provide options for addressing physical, spiritual, psychological, and social needs: indicators of well-being and quality of life. NREs also can have an effect on behavioral responses, thus providing justification for investigation and clarification of evidence on the outcomes of well-being, quality of life, and behavioral and BPSD. Cognitive declines, especially in the attention system, have been noted as contributing to the occurrence of behavioral and psychological symptoms (BPSD) (Berto, 2005; Logsdon et al., 2007). When a patient tries to overcome this diminished ability, they must make an additional and prolonged mental effort (voluntary or directed attention), which causes attention fatigue (Perry & Hodges, 1999). Attention fatigue lowers the patient's ability to concentrate and suppress distraction, heightens their irritability, increasing the likelihood that they might have an accident, fall, and make errors in functioning and

filtering inappropriate behaviors (Herzog et al., 2002; Moore, 2007). This translates into the occurrence of disruptive behaviors in persons with AD, supporting the notion that decreasing events that lead to attention fatigue and restoring the patient's attention are appropriate pathways for diminishing the stress that leads to BPSDs. Natural environments, whether viewed from a window or experienced live, capture attention modestly and peacefully, without requiring the same effort as built environments, thus allowing attention capacity to be renewed (Berman, Jonides, & Kaplan, 2008; Berto, 2005 & 2007).

Providing a patient with environmental support to enhance cognitive reserve and attention capacity, has been recognized as a way to address the psychosocial needs of individuals with dementia and maintain function as long as possible. It is important for both formal care providers (e.g., nurses and nursing assistants) and informal caregivers (e.g., family, friends, and community service providers) to address the physical and mental health of people with dementia. This includes understanding the environmental preferences, experiences, and activities to which the person with dementia responds; promoting these aspects of health; helping the person achieve a sense of mastery; and ultimately enhancing quality of life.

Historically, nonpharmacological interventions for the BPSD of AD have not focused on psychological or emotional well-being and quality of life; and AD treatment was based in pharmacological treatment in attempt to control the BPSDs that were considered to be definitive of the disease process (Reimer, Slaughter, Donaldson, Currie, & Eliasziw, 2004). It is now generally agreed that the concepts of quality of life, well-being, and psychological health are important. Preserving the opportunity for meaningful,

constructive interactions between resident and caregiver is a way to improve quality of life, well-being, and psychological health, and decrease boredom and BPSDs. Previous studies involving NREs have shown that providing opportunities for socialization, attention restoration, and meaningful engagement through gardening activities can impact a patient's quality of life, well-being, social and psychological health, but we have not yet developed enough specific knowledge about best approaches for NRE interventions.

Healthcare professionals must develop an understanding of the use of NRE in different settings, with different modalities, in different dosages, and intensities, to optimize use of NRE as non-pharmacological interventions in AD care. This dissertation analyzes the data presented in existing studies through meta-analytic methods, to add to a solid foundation of current evidence in order to advance individualized and effective evidenced-based interventions.

Theoretical models that provide the basis for the effectiveness of the NRE include cognitive reserve, neural plasticity, and attention restoration. Edward O. Wilson's (1984) theory of biophilia undergirds the basic tenant that humans are biologically connected to all natural things. Two main theoretical models developed around this premise: 1) Kaplan and Kaplan (1989) grounded their theory in the importance for humans of a psychology of nature, which they developed and described as the "Attention Restoration Theory" (ART) (1989); and 2) Ulrich (1984) described a similar theoretical model, the "stress recovery theory". Both of these models link the positive effects of nature (compared to the effects of the urban landscape) and the broad concept of stress mediation. This stress reduction capability of a natural environment, as compared to urban or built environments, has been found in multiple studies (Korpela & Hartig, 1996; Herzog,

Black, Fountaine, & Knotts, 1997; Herzog, Colleen, Maguire, & Nebel, 2003; Kuo & Sullivan, 2001; Ottosson & Grahn, 2005).

Increasingly, long-term care environments are including components of NRE in facility design, both indoors and outdoors. Assisted living and long-term care facilities are incorporating aviaries, fish tanks, live-in pets, and multisensory stimulation rooms into living areas. Interior ambient lighting as well as outdoor gardens, walkways and seating areas outside the facilities are being incorporated into designs of renovations and new facilities. Many disciplines recognize and study the use of NRE with elders and with persons with AD. Researchers and clinicians are interested in outcomes dealing with behaviors, sleep, circadian rhythm normalization, cognition, stress reduction, and quality of life through use of facets of NRE interventions. A few researchers have investigated neural and other physiological measured responses to NRE. Many care facility businesses use outdoor landscaping and indoor natural features (for example, babbling fountains, and large windows with nature views) because they are components that are attractive and valued by consumers and residents. However, research questionnaires suggest that these spaces see limited use, and are often restricted from staff use unless with residents (Cohen-Mansfield, 2007).

Numerous systematic reviews have been published on non-pharmacological interventions for BPSDs; and although recent publications provided the first reviews on NRE in general, none focused exclusively on using NRE in persons with AD (Annerstedt & Wahrborg, 2011; Detweiler et al., 2012). NRE studies tend to be small, most are not randomized clinical trials, and most do not fit standard inclusion criteria for strict Cochrane-type meta-analytic methods (Burgio, Sciley, Hardin, Hsu, & Yancey, 1996;

Connell, Sanford, and Lewis, 2007; Whall, Black, Groh, Yankou, Kupferschmidt, & Foster, 1997). While there have been meta-analyses on bright light therapy and aromatherapy as unique intervention modes, no research syntheses or meta-analyses inclusive of all modalities of NRE as an intervention in persons with dementia was found.

To inform the design and application of future NRE interventions, it is important to understand how variables such as intentionality of application, setting (home vs. assisted living), stage and/or type of dementia influence treatment effect size. Findings from the study proposed here should identify important characteristics of effective NRE interventions: 1) individualized plans; 2) passive versus active engagement; 3) dosages per session and per week; 4) specific NRE interventions; 5) adaptations used; 6) indoor versus outdoor; 7) behavior or outcome targeted; and if possible, 8) the type and/or stage of dementia. The potential long-term benefit of this study would be to help sensitize nurses and other care providers to both the importance of NRE interventions for people with AD and the role these experiences play in care management and the well-being and quality of life of their patients. This knowledge should also assist people directly involved in designing physical indoor and outdoor environments for people with AD, as well as those involved in policy-making guidelines that promote including the NRE when planning new facilities and programs for persons with AD.

Definitions

Conceptual definition of naturally restorative environment (NRE): Naturally restorative environments are those elements of the earth that are living and animate (such as plants and animals), or geographic (land, sea, air, sky), or solar and climatic (rain, sun, stars, wind and snow) that stimulates one or more of the senses. Interventions can

intentionality use NRE for a therapeutic effect (Gibson et al, 2007). Included are active, passive, and interactive approaches, for example indoor or outdoor planting and gardening, walking along a path, or doing chair exercises in a sunroom or patio. No matter how the interaction or exposure occurs, it can provide an abundant source of multisensory stimulation in physical, emotional, behavioral, psychological, spiritual, and/or cognitive domains. The NRE experience may include a passive interaction, such as watching birds through the window, sitting by a light box, listening to bird sounds on a recorder, smelling lavender through an inhaler, or sitting on a bench outdoors, looking at flowers and birds. NRE can involve organic or synthetic presentations of nature. For example, persons in the later stages of AD may not be able to access all sensory stimulation because the areas of their neuro-cortex responsible for sensory interpretation and physical function have been destroyed. In such cases, auditory stimulation of nature sounds, played on a tape recorder, could be used and considered "synthetic" NRE. In contrast, the ingestion of herbs, essential oils, and foods are not included as NRE.

This meta-analysis will not include animal assisted therapy (AAT) interventions because AAT has been subjected to a meta-analysis already. Moreover, AAT is distinct from the inputs discussed here, in that in involves direct interaction with another responsive creature.

Conceptual definition of NRE: To be considered a NRE, the following characteristics must be identifiable in the source: it must contain an element of the earth that is living and animate, geographic, solar, or climatic; it must stimulate one or more of the senses; exposure to the source must be is done with intentionality, for a therapeutic effect; and it must be provided independently of other interventions. An example would

be the use of aromatherapy essential oils for relaxation, but only if that application does not involve ingestion of the essential oil. Stimulation of as many senses as possible, in as natural a state as probable, would be considered optimal, but is dependent upon stage and deficits of the disease process. For example, a person with more ability may be able to participate in planting and maintaining a garden outside, partaking in sunlight, fresh air, and bird sounds. Another resident may be able to fill pots with dirt on a table indoors; whereas someone with more impairment may only be able to watch the birds and listen to nature sounds. The growing and use of fresh flowers and herbs for cooking would be another example of NRE that offers meaningful activities.

Operational definition of NRE: Operationalizing the concept of NRE included the categories of aromatherapy (AT), bright light therapy (BLT), and horticulture therapy or garden use, inside or outside (HT).

Conceptual definition of behavioral and psychological symptoms of dementia: BPSDs include agitation, irritability, apathy, and depression. They may manifest as physical or verbal forms, such as repeated vocalizations, spitting, striking out, yelling, swearing, picking, wandering, and resistiveness to care (Cohen-Mansfield, 1999; Cohen-Mansfield & Jenson, 2008). For the purpose of this study, agitation was used as a broad, general term indicative of any form of physical or verbal BPSD.

Operational definition of behavioral and psychological symptoms of dementia: Many measurement tools are used to observe BPSD. They include the Cohen-Mansfield agitation inventory (CMAI) (Cohen-Mansfield & Billig 1986) the Neuropsychological Inventory (NPI) (Cummings, Mega, Gray, Rosenberg-Thompson, Carusi, & Gornbein, 1994), Behavioral Pathology in Alzheimer's Disease (BEHAVE-AD) (Reisberg,

Borenstein, Salob, Franssen, & Georgotas, 1987), the Bliwise agitation scale (Bliwise, Lee, Carroll, & Dement, 1989), the Social Dysfunction and Agitation Scale (SDAS) (European Rating Aggression Group. 1992). Also included were different behavioral and observation checklists, for example the Dementia Behavior Rating checklist (BRCS) (Mungas, Weiler, Franzi, & Henry, 1989), Pittsburg Agitation Scale (Rosen, Burgio, Kollar, Cain, Allison, Fogleman et al. 1994) and the Dementia Care Mapping (DMC) (Bradford Dementia Group, 1997). These tools measure various forms of physical and vocal agitated behaviors and aggression, and for this dissertation, all were considered operational definitions of BPSD and may be in the included studies.

Conceptual definition of quality of life: Quality of life (QoL) is the extent of positive perception of current life circumstances. QoL is a multifaceted construct including a combination of indicators: health status, social circumstances, environmental circumstances, privacy, dignity, autonomy, economic status, education level, occupation, close relationships, achievement of life goals, ability to cope, self-concept, pervasive mood, and independence in activities of daily living (Moorehead, Johnson, Maas, & Swanson, 2013). Well-being is a narrower construct of QoL and is defined as the extent of positive perception of one's health status (Moorehead et al., 2013). For this study, QoL and well-being were combined and categorized as the broader concept of quality of life; and any component of these concepts was categorized under the broad category of QoL.

Operational definition of quality of life: Any measures of life quality and/or well-being, and components of both (e.g., engagement, affect, day time sleeping) were coded. The perception of QoL might have been provided by the caregiver, as a proxy, or by the resident with dementia, from interviews and focus groups. If informal instruments are

used, the study will have demonstrated pilot work or inter-rater reliability. Studies use several measures to assess QoL. Formal instruments include: the Affective Balance Score (ABS) (Bradburn, 1969), UCLA loneliness scale (Russell, 1996), the Blau quality-of-life scale (Blau, 1997), Gedragsobservatieschaal voor Intramurale Psychogeriatrie (GIP) (Verstraten & van Eekelen, 1988), Life Attitude Profile (Reker & Peacock, 1981), Menorah Park Engagement Scale (Judge, Camp, and Orsulic-Jeras, 2000), Mini-Mental State Exam (Folstein, Folstein, & McHugh, 1975), the Pittsburg Geriatric Center Affective Rating scale (PCGARS) (Lawton, Van Haitsma, & Klapper, 1996), the Revised Social Provisions Scale (Cutrona & Russell, 1987), the Perceived Well-being Rating Scale (Reker & Peacock, 1981), and the Touch Panel Dementia Assessment Scale (TDAS) (Rosen, Mohs, & Davis, 1984).

Overview of Papers

Paper One: Use of the naturally restorative environment: State of the literature (completed): *The importance of getting back to nature for people with dementia*; Bossen, A. (2010). *JGN* 36(2), 17-22. Chapter two updates the review of the literature to include aroma therapy (AT) and bright light therapy (BLT) which were not included in this publication. Chapter two includes the published paper along with the literature review on AT and BLT.

Paper Two: Overview of meta-analysis methods. This paper discusses the unique and specific methodology used in the meta-analysis of NRE interventions for persons with AD that are designed to improve quality of life and lessen BPSDs. A discussion surrounding inclusion of more than rigid randomized controlled trials (RCT) is presented as inclusion criteria for articles in MA is being challenged, especially for psycho-social

interventions. Chapter three includes the process of identifying and conducting moderator analysis.

Paper Three: Findings and discussion. This paper presents the findings of the meta-analysis, discusses implications, and provides descriptive data about what is being used and how. Based on findings, the paper recommends specific interventions (in terms of dosage, timing, environment and activities) according to what is most appropriate for stages of dementia and, if possible, the type of dementia. Future research needs and projects are outlined.

CHAPTER II

THE NATURALLY RESTORATIVE ENVIRONMENT AS AN INTERVENTION FOR PERSONS WITH DEMENTIA

Introduction

This chapter discusses neurobiological and neuropsychological theories for explaining the cognitive and executive function declines that underlie dementia, theories that inform NRE interventions. The concepts discussed include attention capacity, fatigue, neuroplasticity, and cognitive reserve. This chapter will review the current literature of two components of NRE, aromatherapy and bright light therapy; the review of plant-based or horticulture therapy has been reviewed previously (see Appendix A). Since that review, two systematic reviews of nature-assisted therapy have been published; however, neither is specific to persons with AD (Annerstedt & Wahrborg, 2011; Detweiler et al., 2012).

This chapter will also review current perspectives on managing the disruptive behaviors often related to dementia. Extant theories linking environment and behaviors associated with dementia posit that the person-environment interaction and unwanted or disruptive behaviors are congruent paradigms. Research of the past two decades recognizes environment as an important facet of caring for persons with dementia. Some studies theorized that people with dementia show neuro-cognitive changes, less resilience to stress, inattention, and failure to cope with unmet needs, which are triggers for disruptive behaviors.

Disturbing behaviors are often associated with suffering and added burden for the individual, family and caregivers. This strain often triggers premature institutionalization.

Once the patient enters a nursing home, the disruptive behaviors are a source of frustration for care staff, resulting in costly increases in staff time and care dollars; the negative behavior also affects the patient's quality of life (Gaugler, Kane, Kane, Clay, & Newcomer, 2003). Traditionally, these symptoms have been treated with medication and non-pharmacological interventions.

Increasingly, the use of non-pharmacological interventions have become a first-line treatment for managing the behavioral symptoms of dementia, especially because psychotropic medications hold limited efficacy and "black box" warnings (Schneider, Dagaerman & Insel, 2005; Wang et al., 2005). The many approaches to non-pharmacological interventions have been studied, with varying results, leading experts to concur that quality of life, well-being, normalizing life, and limiting behavioral consequences for people with dementia are best addressed by a combination of environment, pharmacology and behavioral modalities (Burh & White, 2007; Logsdon et al., 2007); and address issues of quality of life, well-being, normalizing life, and scheduling rest and activity levels (Kovach et al., 2004).

Nature-based interventions via the naturally restorative environment (NRE) are one strategy for dealing with these behaviors. Although research on the subject has been sparse and disjointed, using the NRE makes intuitive sense and is supported but promising evidence. Scientific studies showed that multisensory stimulation for persons with dementia improved apathy, anxiety, depression, cognition, functional performance, and quality of life (Collier, McPherson, Ellis-Hill, Staal, & Bucks, 2010; Maci et al., 2012) and for the general population, it was shown to enhance cognitive reserve (Berman et al., 2008).

Persons with dementia need treatment tailored to their ever-changing impairments. As dementia progresses the neuro-cortical cells responsible for sensory interpretation and physical function fail, such that while a less impaired person may be able to participate in gardening outside, at the other extreme someone in the late stages of dementia may be only able to hear nature sounds played on a tape recorder. Accordingly, an intervention must match the degree of impairment.

Cognitive Decline in AD

Multiple brain areas cooperate to control general processing activities, such as cognition, attention, and central executive control (Parasuraman & Haxby, 1993). Various of these primary attention systems are differentially impaired by dementia but it is difficult to identify and study precisely which components are affected because they are not easily parsed using the available assessment instruments. Many studies even fail altogether to distinguish the types of attention mechanisms affected. Others that intend to focus on examining executive function can simultaneously capture attentional components, making it difficult to distinguish which individual elements are impaired. Nevertheless behavioral deficits in dementia are readily recognizable and manifest as the loss of both divided attention (the ability to focus on more than one stimulus at a time) and selective attention (the ability to ignore irrelevant stimuli). It may be notable that, in early phases of the disease, sustained attention (focus attention over long periods of time) is spared, though this area of attention has been much less studied than selective attention (Perry & Hodges, 1999).

Executive Function

Executive control, memory, and attention are overlapping systems affected by Alzheimer's disease (AD); while not unitary, distinctive concepts, neuropsychologists and neurologists agree these systems overlap and contribute to each other. Central executive control, as presented in several models, guides attentional control of action and cognitive regulation, to provide higher order executive functioning capacities (e.g., planning, problem solving, memory formation, and managing unexpected or new events) (Baddeley & Wilson, 1988; Norman & Shallice, 2000, from Baddeley, Eysenck, & Anderson, 2009, p.53). Executive control, attention and memory arise from activity in the frontal cortex, with input from the medial temporal lobe (which includes the hippocampus) (Buckner, 2004; Knudsen, 2007).

Attention Capacity/Fatigue

The attention system is comprised of various processes that involve cognitive states and operations that detect and select stimuli, consolidate information, manage resources for processing competing stimuli, and assist in retention and recall (Baddeley & Wilson, 1988; Perry & Hodges, 1999). Attention has also been demonstrated to be a critical component for intact memory (Baddeley et al., 2009). Theoretically, attention is divided into three separate subsystems that can be functionally and anatomically defined: 1) selective attention, which includes the capacity to ignore competing stimuli; 2) sustained attention, responsible for maintaining focus over time; and 3) divided attention, which allows sharing of attention resources (Parasuraman & Haxby, 1993; Perry & Hodges, 1999). In a different theory, attention may be divided depending on the effort required is involuntary or voluntary (directed); voluntary or directed attention requires

one to exert energy and effort, while involuntary attention is engaged automatically (Kaplan & Berman, 2010). These distinctions (voluntary vs. involuntary) are not necessarily independent; however, they may arise from different neural foci. As Kaplan postulates, involuntary attention is consistent with bottom-up processes (parietal lobe) and voluntary attention associated with top down processing (pre-frontal cortex) (Kaplan & Berman, 2010). Various circumstances require different degrees of attention. The more demanding stimuli, whether external or internal, the more exhausting it becomes (Cimprich & Ronis, 2001). Environmental stimuli might come from excessive noise and psychological stress (e.g., illness, time pressure, emotions, or personal threats). Internal stimulation occurs, for example, because the disease process causes the patient have difficulty functioning, so they need to expend additional effort. It is voluntary attention that becomes fatigued and involuntary attention that allows attention capacity to rest and recover. This provides the basis for attention restoration therapy (ART).

Researchers have been able to recreate the cycle of attention (mental) fatigue and subsequent attention restoration. In studies using college students, subjects perform cognitive tasks to induce mental fatigue and then are exposed to nature scenes for attention restoration; the students who viewed nature scored higher on tests of attention (Berto, 2005). The importance of restoration of attention was demonstrated in women newly diagnosed with breast cancer compared to a control group of women having routine mammograms (Cimprich & Ronis, 2001). The intervention group showed high levels of attentional fatigue that was sustained over time which the authors demonstrated interfered with their abilities to learn self-care, decision making, adhere to complex treatment schedules, and potentially cause unrelieved psychological distress (Cimprich &

Ronis, 2001). The women demonstrated significantly improved capacity to direct attention by spending 120 minutes per week in an NRE experience.

Fascinating stimuli presented by the natural environment captures attention effortlessly by drawing us into remembrance and wonder. It is this effortless multisensory stimulation from NRE that is relevant for persons with AD (Berman et al., 2010; Berto, Baroni, Zainaghi, & Bettella, 2010).

Neuroplasticity

A discussion of neuroplasticity is crucial because it refers to the brain's ability to reorganize itself. Neuroplasticity is the process of neuronal modification as a reaction to a changing environment (Sotiropoulos, Cerqueira, Cataniam, Takashima, Sousa, and Almeida, 2008). Age plays a principle role in neuroplasticity and holds for persons young and old, though in opposite directions: in early development, newly generated neurons proliferate rapidly, thus promoting plasticity; in aging cells, some research indicates that existing neurons and synapses show decreased plasticity due to chronic elevated levels of glucocorticoids from stress (the "glucocorticoid cascade hypothesis" of stress and aging) (McEwen, 2007; Morrison & Hof, 1997). Neuro-plastic alterations are stimulated by different events and neurochemicals that produce positive and negative consequences (McEwen, 2007). New neural networks may form from new experiences, learning, physical activity, sensory stimulation, environmental enrichment, and other cognitively challenging activities. (Berton & Nestler, 2006; Kemperman, Gast, & Gafe, 2002; Wong & Ghosh, 2002; Zito & Svoboda, 2002).

Cognitive Reserve

Cognitive reserve (CR) theory proposes two components: active, or functional CR, represents the efficiency of neural networks; and passive CR, also called "brain reserve", is the anatomical and structural components (Fairjones, Vuletich, Pestell, & Penegyres, 2011; Kolanowski, Fick, Clare, Therrien, & Gill, 2010). The active system consistently correlates with pre-morbid intellect, education, and occupational achievement and is responsible for recruiting new strategies and network connections after insult or injury (Roe, Xiong, Miller, & Morris, 2007; Stern, 2009 & 2002). The passive system is limited by a threshold, with the function or ability to withstand insult dependent upon brain size and synaptic density (Stern, 2002). The two components, brain reserve and cognitive reserve, are called upon to interact and give a globally mediated function. CR contributes to the pathology seen in AD, with higher CR associated with lowered risk of developing AD and reduced burden of AD (Alexander et al., 1997 Stern, 2002 & 2009). Cognitive processing, needed for attention functions and executive control, requires resource allocation of attention capacity and/or cognitive reserve. Capacity within the attentional system varies among individuals and is limited (Lezak, 1995). In AD, cognitive reserve erosion manifests as deficits of the attentional system (Fairjones et al., 2011) and may be the result of physiological damage, as in AD, resource depletion or ineffective deployment (Perry & Hodges, 1999). Improving neural mediation of CR may enhance task performance and support restoration enabled through the environment (Petrosini et al., 2009; Stern, 2009).

Much of the literature on CR is based on work that associates variables like enriched environments, literacy, complex leisure activities, sustained physical activity,

and early cognitive abilities with decreased risk of later cognitive decline (Petrosini et al., 2009; Roe et al., 2007; Stern, 2002 & 2009). These enhanced sensorimotor, cognitive, and social environments are considered to result in changes in brain biochemistry, neuronal function, and synaptic connectivity, and are the focus of interest in interventions that support attention capacity and can be provided through NRE.

Attention in AD Behaviors

Cognitive declines, especially in the attention system, contribute to the behavioral and psychological symptoms of dementia (BPSD) (Berto, 2005; Logsdon et al., 2007). Overcoming this diminished ability takes additional and prolonged mental effort (in voluntary or directed attention), leading to attention fatigue (Perry & Hodges, 1999). Attention fatigue lowers the ability to concentrate, suppresses distraction, heightens irritability, increases the likelihood of accidents, and predisposes the patient for errors in functioning and filtering of inappropriate behaviors (Herzog et al., 2002; Moore, 2007). Attention fatigue in persons with dementia manifests as disruptive or catastrophic behaviors and less tolerance to stress, as described in the progressively lowered stress threshold (PLST) model (Hall & Buckwalter, 1987). The various precipitating factors of disruptive behaviors can be specific to individuals; while some of these factors have root in brain neuropathy or neurochemical basis, behaviors may also be exacerbated or triggered by environmental and/or interpersonal interactions (Logsdon et al., 2007).

The importance of the environment has long been studied in relation to the care of persons with AD (Burgio et al., 1996; Calkins, Szmerekovsky, & Biddle, 2007; Connell et al., 2007; Lee & Kim, 2008). The occurrence of behaviors such as aggression and agitation, have been linked to an environmental mismatch or “press” (Day, Cameron, &

Stump, 2000). Humans' natural connection to nature makes interaction with the natural environment important to life; some psychologists even classify it as a basic need (Kaplan & Kaplan, 1989). This is not changed by AD. Nature has been demonstrated to be rich in restorative elements, provide multisensory stimulation, elicit a sense of peace and well-being, and have healing qualities (Berto, 2007; Gerlach-Spriggs, Kaufman, & Warner, 1998; Kaplan & Kaplan, 1989).

Nonpharmacological Interventions

Non-pharmacological interventions for persons with dementia have been the focus of several meta-analyses and systematic reviews (Ayalon, Gum, Feliciano, & Areán, 2006; Kong, Evans, Guevara, 2009; O'Connor, Ames, Gardner, & King, 2009, O'Neil, Freeman, Christensen, Telerant, Addleman, & Kansagara, 2011; Seitz et al 2012). Contradictory results were found in specific modalities, but all authors identified methodological constraints that restrict inclusion of many primary study results. Each review identified different methodological issues that determined whether factors would be included or excluded for consideration. The findings presented both consistent and conflicting results. Generally, sensory stimulation (e.g., aromatherapy, touch, hand massage, and music therapy) were identified as having sufficient evidence to argue that they might therapeutically manage disruptive behaviors (Kong et al, 2009; O'Neill, et al., 2011; Seitz et al., 2012; O'Connor et al, 2009).

Interventions not having sufficient evidence included simulated presence activities, acupuncture, pet therapy, bright light therapy, and caregiver training focused on behavior management techniques (Kong et al., 2009; O'Neill et al., 2011; Seitz et al., 2012; O'Connor et al., 2009). None of these reviews estimated pooled effect sizes, and

the researchers recognized that the studies they reviewed were influenced by non-standardized terminology, small sample sizes, and variability in outcome measurement scales. As a result, the conclusions and recommendations for efficacy of specific nonpharmacological interventions were not consistently endorsed. Though, interventions in the sensory realm were endorsed as potentially efficacious for persons with AD. Nevertheless, both the Ayalon study (2006) and the O'Connor study (2009) argued that, regardless of the specific method used, a key to efficacy is tailoring the intervention to the patient's needs.

Aromatherapy

Definition

Aromatherapy (AT) uses plant-based essential oils (EO) to affect the brain and body (Kamen, Fung, Tsang, & Chung, 2012). While the strict definition of AT indicates solely the sense of smell (Buchbauer & Jirovetz, 1994), the term AT has seen broader acceptance for therapeutic use of aromatic plant components in combination with massage.

Mechanism of action

Essential oils are transferred into the body in two ways: inhalation causing both reflective and central nervous system effects, and transdermal absorption into the blood stream which causes higher uptake of the chemical components (Buchbauer & Jirovetz, 1994). Transdermal absorption of the chemical component(s) of the essential oils or by stimulating the olfactory nerve via absorption through the nasal epithelium is suggested by several authors (Buchbauer & Jirovetz, 1994; Snow, Havanec, & Brandt, 2004). These

physiological effects are mediated by neurotransmitters through the hippocampus and amygdala of the limbic system.

Significant changes in psychology a play role in the process. Psychological theory proposes that in the amygdala, links are formed that are attributed to specific aromas (Cavanagh & Wilkinson, 2002; Nguyen & Patton, 2008). The physiological effects are combined with the psychological links producing a response. Essential oils (fragrances) have different chemical properties, and therefore elicit differing cellular responses. The mode of action is hypothesized to have similar action to the benzodiazepines and to enhance the effects of gamma-aminobutyric acid in the amygdala, which enhances cognitive abilities (Cavanagh & Wilkinson, 2002).

This theory was tested in a pilot study that first sought to determine if residents with AD could identify fragrances; and then test whether the fragrances had an effect on attenuating behaviors (Snow et al., 2004). In their small sample size of seven, four participants were found to be completely anosmic, while the other three had some olfactory capabilities. Moreover, their findings were inconsistent across treatment phases, indicating no evidence to support use of AT in attenuation of behaviors (Snow et al, 2004). This finding, however, conflicted with several other studies (Ballard, O'Brien, Reichelt, & Perry, 2002; Fujii et al., 2008; Lin, Chan, Ng, & Lam, 2007; Smallwood, Brown, Coulter, Irvine, & Copland, 2001).

Some people with dementia cannot readily discriminate, recognize, and identify odors (Doty, Reyes, & Gregor, 1987; Murphy, Gilmore, Seery, Salmon, & Lasker. 1990), a condition called anosmia. Though anosmia is more prevalent in Lewy Bodies dementia as opposed to Alzheimer's (McShane et al., 2001) anosmia could preclude the use of AT.

Nevertheless, questions remain as to whether anosmia affects all patients equally, and whether it prevents the benefits of AT.

Outcomes of AT

There are many purported outcomes used in the treatment of AD including relaxation, improved cognitive functioning, sleep, quality of life (shown through increased engagement in constructive activities and feelings of well-being), and relationship with family carers, and decreased anxiety, depression, motor restlessness, and physical agitation. Three systematic reviews address the efficacy of AT (Kamen et al., 2012; Holt, Birks, Thorgrimsen, Spector, Wiles, & Orrell, 2003; Nguyen & Patton, 2008). All three included only randomized controlled trials and reviewed eleven, eleven, and four studies, respectively. Both the Kamen (2012) and Holt (2009) reviews identified statistically significant benefits of AT in managing the behavioral and psychological symptoms of dementia (BPSD). However, a poor risk/ benefit ratio of AT considering the potential side effects, limited understanding of the biological basis, and the limited and questionable study quality, were questioned in evaluating efficacy (Nguyen & Patton study, 2008). Other literature does substantiate this concern as there are potential health risks with EO use. Sensitivity to the compounds may cause allergic reactions to skin or more systemic responses, and potential toxicity when different compounds are used (Edris, 2007).

Lavender is the most commonly used AT fragrance, a scent associated with calming, smooth-muscle-relaxing, sedative properties. Another commonly used herb is *Melissa officinalis* (lemon balm) that reportedly affects acetylcholine receptor activity in the central nervous system, with both nicotinic and muscarinic binding properties (Wake,

Court, Pikering, Lewis, Wilkins, & Perry, 2000). Other fragrances and their main properties are summarized (see Table 2.1).

Study characteristics

The types of outcome measures reported from AT studies include: behaviors, cognitive function, functional performance, sleep, mood, quality of life, wandering, and relaxation. Studies were considered that measured outcomes with well-established tools: the Cohen-Mansfield Agitation Inventory (CMAI) (Cohen-Mansfield & Billig, 1986); Neuropsychiatric Inventory (NPI) (Cummings et al., 1994); Pittsburg Agitation Scale (Rosen et al., 1994); and BEHAVE-AD for agitation (Reisenberg et al., 1987); the Mini Mental State Exam (MMSE) (Folstein et al, 1975); ADAS-cog (Rosen et al., 1984); the revised Hasegawa's Dementia Scale (Katoh et al., 1991); Gottfries, Brane, Steen Scale (GBSS-J) clinical Dementia Rating Scale (CDR) (Gottfries, Bråne, Gullberg, & Steen, 1982); and the Touch-panel-type dementia assessment scale for cognitive function (TDAS) (Inoue, Meshitsuka, Yoshioka, and Kawahara, 2000); Activities of daily living were measured with Barthel Index (Mahoney & Barthel, 1965), the Chinese version of the Barthel Index (Leung, Chan, & Shah, 2007), and the Functional Assessment Staging (FAST) (Reisberg, 1987). Quality of life was measured with the Blau Quality of Life Scale (Blau, 1977), the Life Satisfaction Index (Chinese version) (Chi & Boey, 1992), or the UCLA Loneliness scale (Russell, 1996). In addition, qualitative measures such as staff perceptions were noted.

In all, data from eleven studies were compiled (see Table 2.2). As anticipated, the studies varied considerably, using different types of fragrance, amounts of essential oil, applications, frequencies and duration of AT treatments. All participants were in the later

stage of dementia, with concomitant agitation or other BPSD. Ten of eleven used nursing home populations, while the other ran in an inpatient gero-psychiatric unit. AT was administered by essential oil (EO) massage, whether on hands, face, feet or a combination (two studies); putting EO on participants' clothing (four studies), EO in participants' footbaths and/or pillows (one study), and EO in some form of diffused mist (four studies). Many studies failed to report the concentration of the EO they used. Two studies by Akhondzadeh and colleagues, (2003, a/b) were excluded despite that they tested essential oils from two herbs, *Melissa officinalis* and *Salvia officinalis*; in these studies rather than delivering EOs olfactory stimulation, they were consumed orally. Exclusion of these studies highlights the current debate as to whether olfactory stimulation alone is the only route for AT. Nevertheless, these studies were classified as an herbal treatment rather than an aromatherapy.

Regarding fragrances used, lavender was used for three studies (Holmes, 2002; Lin et al., 2007; Smallwood et al., 2001). These studies used a combination of fragrances (lavender, tea tree, orange, lemon balm, rosemary, thyme, chamomile, geranium) to bring about different anticipated responses (Burleigh & Armstrong, 1997; Gray & Clair, 2002; Snow et al., 2004). The specific fragrances were administered at different times of the day: for example, rosemary and lemon in the morning for stimulation and alertness; and lavender and sweet orange in the evening for calming and smooth muscle-relaxing effects (Jimbo, Kimura, Taniguchi, Inoue, & Urkakami, 2009). Three studies used only *Melissa officinalis* (lemon balm) (Akhondzadeh et al., 2003; Ballard et al., 2002; Burns et al., 2011).

AT trials varied in dosage (e.g., frequency, intensity, and duration). The least frequent was 2 times per week, twice a day (Smallwood et al., 2001), to the most frequent being several times daily; however their trial duration was only for a total of 16 administrations (4 doses of each fragrance) (Gray & Clair, 2002). Some administrations were long lasting, as essential oil-soaked cotton balls were attached to clothing, replaced three times a day and worn all day long (Snow et al., 2004; Fujii et al., 2008). The general time intensity and frequency was for the oils to be massaged onto the skin once or more per day (Ballard et al., 2002; Burleigh & Armstrong, 1997; Burns et al., 2011; Smallwood et al., 2001) or for a two-hour period whether via diffuser by the bedside or near the participant (Holmes et al., 2002; Jimbo et al., 2009; Lin et al., 2007; Sakamoto et al., 2012).

Results of AT

Two of the eleven studies showed no significant changes in behaviors or quality-of-life measures (Gray & Clair, 2002; Snow et al., 2004). Contributing factors to these findings may be that the Gray and colleagues study (2002) had the smallest sample size while the other had the lowest dosage. Some of the other studies reported significant outcomes for the treatment groups, such as decreased in physical and verbal agitation, motor and nighttime restlessness, less assistance with ADLs, improved mood or affect, cognitive function, and improved feelings of well-being (see Table 2.2. for significance levels).

Side effects with AT, however, were reported more than with other forms of NRE, especially when the essential oils were administered orally (Akhondzadeh et al., 2003, a/b). These studies were excluded from the MA. Some studies reported side effects,

but many did not assess them systematically. The side effects mentioned included vomiting, nausea, diarrhea, dizziness, wheezing, and topical reactions, suggesting the need for allergy testing before beginning any AT fragrance, as well as the need for closely monitoring AT participants (Ballard et al., 2002; Burleigh et al., 1997; Smallwood et al., 2001.

Discussion of AT

Many questions about AT remain. How do different fragrances work, from a biological/physiological perspective? Can they work together? And how do we determine/avoid side effects? Even when AT seems to be effective, a cost/ benefit analysis must consider side effects in this vulnerable population. Also, olfactory capacity must be addressed, to determine if the decline of capacity included the physiological response to fragrances or just the ability to distinguish between fragrances, identify them, and be able to consciously smell them. As Vance (2003) points out, in a clinical setting, when therapy includes reminiscence, it may be illusionary to think a smell can stimulate memories when smells are often not identifiable.

Overall, the studies were mainly randomized controlled trials, yet some methodological discrepancies require consideration when interpreting and generalizing the findings. Several studies did not control for concomitant psychotropic drug administration, other studies did not report blinding, and power calculations were missing in a few. Nevertheless, the overall efficacy of AT shows promise in this population. Questions remain regarding how to determine the fragrance, when a fragrance should be used and for how long, and the best route of administration. Another gap in the literature is the outcomes evaluated. AT is targeted at responding to the need for better

management of BPSD. Few studies looked at cognition and only one looked at quality of life/ well-being issues, suggesting areas for more research.

In a clinical sense, AT requires some specialized equipment and knowledge that current long term care personal maybe unlikely to have. No studies addressed the issues surrounding whether an aroma therapists is essential, AT can be done in a group setting, how it could be integrated into a population larger than one individual at a time, and how it maybe generalized. Feasibility studies need to be conducted to address these issues.

Bright Light Therapy

Definition

Bright light therapy uses either natural or synthesized light using a variety of light sources for therapeutic purposes. BLT approaches consist of specific wavelengths, polarized light, light emitting diodes, fluorescent lamps (i.e. dawn-dusk simulation, light visors worn on heads, ambient light, light boxes). Generally, light is administered for a prescribed amount of time and often, at a specific time of day.

Mechanisms of action

Several reviews of BLT for persons with AD support the mechanism of action for BLT as related to circadian rhythms. The suprachiasmatic nuclei (SCN), that is located in the hypothalamus of the brain, is the driver of the biological clock and regulated the circadian rhythms (Hanford & Figueiro, 2012). The cycles of the circadian rhythms are constantly stimulated by the outside environment, specifically, by the changing ambient light mediated through the light-sensitive receptors of the retina. Other aspects of our lives help direct circadian rhythms, such as social cues, meals, and schedules that occur with regularity, that help us navigate our day and night. When the exposure to this light is

interrupted, for example, by institutionalization, sleep cycles are disrupted, possibly causing sleep disturbances, thus resulting in day and night-time behavioral issues (McCurry, Reynolds, Ancoli-Israel,Teri, & Vitiello, 2000).

Other causal issues related to sleep/ behavior disturbances addressed by BLT are body temperatures, time of day and serum melatonin levels (Haffmans, Sival, Lucius, Cats, & Van Gelder, 2001; Hanford & Figueiro, 2012; Kim, Song, & Yoo, 2003; McCurry et al., 2000). While studies of the elderly have demonstrated reduced neuronal activity in the SCN, it has not been shown that dementing illnesses further impacts the decline of neuronal activity of normal aging and thus circadian rhythmicity (Ancoli-Isreal et al., 2003; Mishma, Okawa, Hishikawa, Hozumi, Hori, & Takahashi, 1994). The circadian cycle is dependent upon the responsiveness of the SCN, and the timing of the light/dark and melatonin levels. The random patterns of sleep/ wake cycles experienced by persons with AD cause the disruption in rest/ activity rhythms, implicating BLT as a method of improving sleep efficiency. Indeed, researchers point to the notion that the delaying or redirecting of the biological clock is dependent, in part, to when the light therapy exposure occurs (Shirani & St. Louis, 2008).

The target of BLT in attempting to reset the phase of the biologic clock is relative to the amplitude and timing of light. As Shirani and St. Louis (p. 158, 2008) describe: "the common goals of light therapy include: 1) synchronizing the sleep-wake cycle with the subjective night; 2) shifting the biologic clock phase to facilitate sleep at a desired time of day/night; and 3) advancing the biologic clock phase to attain indirect effects on mood." They point out that although it is possible to alter the biologic clock, timing of BLT is dependent upon the identification of circadian windows of opportunity for clinical

intervention along with the variables of wavelength and intensity (Shirani & St. Louis, 2008).

Outcomes of BLT

According to the International Psychogeriatrics Association (IPA), BLT provides a promising treatment for sleep disturbances and also for agitation. Each of the reviews described outcomes of BLT in three areas: sleep-related variables, behavior disorders (including agitation, sundowning, wandering, nocturnal delirium, motor and verbal restless behavior) and the effects of bright light on circadian rhythm in terms of body temperature and serum melatonin (Haffmans & Figueiro, 2013; Kim et al., 2003; Skjerve, Bjorvatn, & Holsten, 2004). All of the reviewers report mixed results of BLT along with no standardized dosages, modalities, or timing of therapies.

The updated Cochrane review of bright light therapy (BLT) for BPSD in AD reports inadequate evidence of the effectiveness "of BLT in managing sleep, behavior, cognitive, or mood disturbances associated with AD" (p. 2, Forbes, et al., 2004). While the findings don't support a general endorsement of BLT, the authors do suggest a possible rationale for BLT, and continuing research of BLT for managing important issues in AD patients. However, the authors found many of the studies they reviewed to be of poor quality with too much variation in the design of interventions.

Study characteristics

In the eleven BLT studies included, six studies employed a comparison group, randomized controlled trial design, three used a cross over design, and two were pre-post-test design studies. The outcome disruptive behaviors were studied in all eleven studies, while quality of life (QoL) was included as an outcome studied in four of the studies.

Instruments used to measure the outcome BPSD included; four studies used the CMAI (Cohen-Mansfield & Billing, 1986), two studies used the Behave-AD (Reisberg et al., 1987), two studies used an observation of BPSD, one study each used the Bliwise Agitation Behavior Rating Scale (Bliwise et al., 1989), and the Social Dysfunction and Aggression Score (European Rating Aggression Group, 1992).

The participants of nine of the studies had ratings of sever AD, while the remaining two studies the participants had a mixture of severity scores. Nine studies also reported evidence of existing BPSDs. Three of the studies were done in a gero-psych inpatient unit, while the other eight were conducted in nursing homes. There were a total of 330 participants, with an average group size of 24. Duration of treatment ranged from one week to 68 weeks, with a mean duration of 10.5 weeks. The frequency was relatively consistent with daily administration of BLT. One study applied the treatment five times a week. Intensity of the treatment averaged 75 minutes, with a range form 30-120 minutes. All but one study used light boxes with a staff person attending to the participant sitting in front of the apparatus, while two studies encouraged increased time spent outdoors, and supplemented with light box treatments. Six of the studies included morning administration of the treatment, while others didn't specify or included a dim light or afternoon control group. All studies had the moderating variable of having some form of socialization or attention as the participant either had a staff present during treatment with the light box, or in the two instances of some outdoor natural light, the exposure to BLT was in a group (see Table 2.3 for results).

Results of BLT

As presented in Table 2.3, there are conflicting findings of individual studies. Some methodologically strong studies suggest efficacy of BLT on sleep and behavior (Lovell, Ancoli-Isreal, & Gervitz, 1995; Mishima et al., 1994; Riemersma-van der Lek et al., 2008). Others find less efficacy (Ancoli-Israel et al, 2003; Lyketsos, Veiel, Baker, & Steele, 1999) or an increase in agitation with the intervention (Barrick et al, 2010; Dowling, Baker, Wareing, & Assey, 1997; Haffmans et al., 2001; Schindler, Graf, Fischer, Tölk, & Kasper, 2002). These discrepancies necessitate the evaluation of the study design and moderating factors.

The report of fidelity to treatment parameters is missing in many studies, even though the procedures are described in detail. This is apparent in the sample sizes as only three of the studies discussed attrition. When working with the AD population, attention is often limited, so expecting that residents sit for long periods of time (30–120 minutes) is not feasible, jeopardizes research fidelity, and increases participant burden. Several of the articles, even the RCTs, failed to mention whether they did a power analysis to establish an adequate sample size. Some studies reported eye irritation or increased agitation from the intervention (Fetveit, Skjerve, & Bjorvatn, 2003; Schindler et al, 2002), though most of the studies did not report any negative consequences and took precautions, such as using sunscreen for participants exposed to direct ambient light.

In reviewing results, there are many differing intensities, durations, and lux levels used in the individual studies. Additionally, there are different methods of administration. Some researchers identify the biological valence for effectiveness of BLT as inherent on 2 characteristics; wavelength and intensity (Shirani & St. Louis, 2008). Wavelength is

reported in terms of color spectrum, while intensity is designated by lux. Early BLT studies used white light with the "dose" being between 7000-12,000 lux to equal standard ambient sunlight during daylight (Shirani & St. Louis, 2008). The studies reviewed here have a range below this lux, however, as more recent studies are finding that shorter wavelength –blue-green light range has greater potential for the phase shifting necessary for circadian rhythmicity to normalize (Shirani & St. Louis, 2008; Loving, Kripke, Knickerbocker, & Grandner, 2005). The majority of the studies reported using a soft white light from light boxes or lamps (Ancoli-Israel et al, 2003; Burns, Allen, Tomenson, Duigman, & Bryne, 2009; Lovell et al, 1995; Mishma et al, 1994). One used a "light room"(Van Someran, Kessler, Mirmiran, & Swaab, 1997), while others used ambient light encouraging participants to increase their time spent outdoors while measuring the exposure by Actillume wrist actigraphs (Alessi, Martin, Webber, Kim, Harker, & Josephson, 2005). The range of lux reported in the studies was 2500–10000 lux.

Another relevant factor in the circadian cycle is the timing/time of day for exposure. Circadian rhythm sensitivity is affected by short term light exposure history, the higher the light exposure during the day, the lower the sensitivity to light (Hanford & Figueiro, 2012). The measure for this is by melatonin suppression and phase shifting (Hanford & Figueiro, 2012). This was seen in the studies as several incorporated the administration of melatonin in the intervention in one of the experimental comparison groups (Haffmans et al., 2001; Riemersma-van der Lek et al., 2008). Nineteen of the studies administered the treatment in the morning hours, including those that had comparison groups in the evening, all day, and standard comparison administration times. Duration of the treatment also differed with between 30 minutes to "all day" identified as

treatment times. Time for circadian sensitivity is relatively short, positing that it only takes a "few minutes" for response (McCurry et al., 2000; Shirani & St. Louis, 2008). There did not appear to be an "average" time for length of study; some were as short as 5-7 days (Alessi et al., 2005; Satlin, Volicer, Ross, Herz, & Campbell, 1992), others as long as several years (Riemersma-van der Lek et al., 2008).

In a qualitative study female residents (n=20) of a long term care facility were introduced to BLT to look at how caregivers perceived the life of the residents on global function (Nowak & Davis, 2011). They used a randomized two group experimental design with repeated measures. One received blue-green light exposure in the morning (30 minutes of 12,000 lux) with the control group receiving dim red light 30 minutes of 5 lux through a cap visor. Both treatment conditions were administered for 14 days. This was the only study where gender was evaluated or used as exclusion criteria. There was an expressed difference between the groups; the treatment group was perceived to be more awake and alert, more verbally and physically competent, engaged more fully with their surroundings, and to have improved recollection and recognition and recapturing some of their previous personality (Nowak & Davis, 2011). Interestingly, the researchers found the dim red light group experienced more calmness and less resistiveness to cares. Caregivers recorded statements like, "She is usually so rude,…it is like she is a different person", "she doesn't make that sound now when she wheels herself around", and "she doesn't flare up so much" (p.943, Nowak & Davis, 2011). Statements about the blue-green light group included examples like, "she just seems brighter", "she was able to feed herself better", "she seemed more aware of what was going on", "she seems so much

more content and calm", and "she agreed and we were able to take her out to church" (p. 943, Nowak & Davis, 2011).

Discussion of BLT

There were several studies suggesting that BLT provides beneficial outcomes, yet several gaps remain. There are questions as to standardization of intervention characteristics such as; wavelength, intensity, timing- whether morning or evening light is better, stage of AD that is most responsive, and whether there are differences in response by types of dementia. Other issues involve efficiency and cost for implementation into a long term care setting. While the main outcomes being studied are sleep and BPSD, other consequential outcomes have not been studied. Investigations should also focus on quality of life and well-being.

There is an obvious need for more randomized controlled trials that compare outcomes and moderating variables like wavelength and intensity, timing of treatments, and efficient ways to administer treatment for persons with AD. This is an especially pertinent issue as the diminished attention capacity and limited stress threshold experienced in dementing illnesses. Lighting apparatuses need to be designed that do not require prolonged sitting in front of a light box to receive treatment. An additional strength of NRE interventions occurring outdoors is the use of natural sources of light; however, there needs to be consideration of how to deal with the effects of the weather on activities.

There is little evidence that increasing exposure to higher light levels is harmful, while there is some evidence that it may help. Research issues like small sample sizes and difficulties in methodology make showing statistical significance difficult, and there is

inadequate evidence for a supportive Cochrane review (Forbes et al., 2009). There is however, enough evidence to identify potential clinical benefits. The research of Nowak and Davis (2011) are good examples of the clinical contribution of qualitative studies in BLT. Not only have they demonstrated an efficient modality for administering the treatment, but they have captured the impact of the BLT has from the carer's perspective. It appears that multifaceted approaches, like Alessi et al., (2005) presented of increased physical activity, discouraging day time sleeping, increased ambient light exposure does have positive results in the quality of lives of persons with AD.

The Cochrane findings suggest future researchers incorporate randomized controlled parallel-group design with statistically appropriate analysis, more acceptable randomization technique (computer generated), powered sample sizes, and blinding (Forbes et al., 2009). These are similar to the suggestions for future research by other authors who did systematic reviews.

Table 2.1 Summary of fragrances and reported properties

Essential oil (EO)	Reported properties	Studies
Chamomile	Anti-anxiety, stress Sedative	Burleigh et al., 1997
Citrus	Anti-oxidative properties Sedative	Jimbo et al., 2009 Gray & Clair, 2002 Kilstoff et al., 1998
Geranium	Sedative	Kilstoff et al., 1998
Lavender	Mood alteration Anti-anxiety, stress Sedative, sleep promotive	Jimbo et al., 2009 Snow et al., 2004 Lin et al., 2007 Gray & Clair, 2002 Fujii et al., 2008 Smallwood et al., 2001 Burleigh et al., 1997 Holmes et al., 2002 Kilstoff et al., 1998 Sakamota et al., 2012
Melissa officinalis	Mood alteration Antiviral Anti-oxidative properties Sedative	Ballard et al., 2002; Jimbo et al., 2009 Burns et al., 2011
Rosemary	Anti-anxiety, stress Sedative	Jimbo et al., 2009 Burleigh et al., 1997
Sweet marjoram	Smooth muscle relaxation Sedative	Burleigh et al., 1997
Tea tree	Antiviral Anti-oxidative properties Smooth muscle relaxation	Gray & Clair, 2002
Thyme	Anti-oxidative properties Antibacterial Sedative	Snow et al., 2004

Table 2.2 Summary of characteristics of studies on AT

Author	Study design	Sample	Describe intervention details	Int	Dur	Freq	Outcomes
Ballard et al., 2002	RTC	72	Melissa EO Applied to arms and face	2	4	2x/d	(Z=4.2, p<.0001), and improving QoL, (Z=3.5, p=.001)
Burleigh et al., 1997*	With-in subjects	7	Choice of Rosemary, chamomile, lavender, marjoram-EO managed by AT; mixed admin. Route by bath/ foot bath, on pillow	varied 2-20	9	5/ week	5 subject saw decrease BPSD; 6 required less help with ADLs
Burns et al., 2011	RCT	77	3 groups; placebo med & AT; active meds & AT; placebo both; melissa EO massaged into hands and arms	5	12	daily	QoL p=0.033; Depression p=0.017
Fujii et al., 2008	RCT	28	Lavender oil on collar after meals replaced	60	4	24/7	NPI p=0.01
Gray & Clair, 2002*	Obser-vational	13	During med administration observed for 5 minutes; 4 different aromas; lavender, sweet orange, tea tree, none. EO on cotton balls attached to clothing prior to med admin	20	2.5	sev times/ day	NS
Holmes et al., 2002	RCT	30	Lavender oil in mist	120	18	sev times/ week	PAS p=0.016
Jimbo et al., 2009	Placebo control within group	28	Rosemary & melissa EO in am; orange & lavender in pm; 28 d tx; 28 d wash out; EO on gauze and then in diffuser	60	10	Daily x 28 day	GBSS-J p<0.05; TDAS p<0.01

Table 2.2 continued

Author	Study design	Sample	Describe intervention details	Int	Dur	Freq	Outcomes
Lin et al., 2007	RCT; cross over	70	Lavender EO on cloth at bedside	60	8	daily	CMAI p<0.001NPI p<0.001
Sakamoto et al., 2012	RCT	145	3 NH patches placed on clothing near neck.	60	52	24/7	decreased falls, HR= .57 (0.34-0.95)
Smallwood et al., 2001	RCT	14	3 groups; AT (mist) and conversation, AT and massage, and mass. Only;	5	4	2x/wk	decreased motor behavior with morning AT p<0.05
Snow et al., 2004	CT-ABCBA	7	2gtts q3 hrs/d; A=lavender; B=thyme; C=no scent; EO placed on cotton pad on collar	60	19	2 wks of each cond-ition	NS

ADAS-cog=Alzheimer's Disease Assessment scale-cognition; AT=aromatherapy; BSPD=behavioral and psychological symptoms of dementia; CMAI=Cohen-Mansfield Agitation Inventory; EO=essential oil; GBSS=Gottfries, Brane, Steen and Scale; NPI=neuro-psychiatric inventory; NS=not significant; PAS=Pittsburg Agitation Score; QoL=quality of life; RCT=randomized controlled trial; Tx=treatment; *=not included in Meta-analysis

Table 2.3. Summary of studies on outcomes and characteristics of BLT

Articles	Study Design	Total sample	Timing	Intensity Lux	Duration hours/day	Outcomes
Alessi et al., 2005	RCT	118	Mostly morning; ambient-outdoors	10000	30/5	Decrease in daytime sleeping and increase in social participation
Ancoli-Israel et al., 2002	RCT	46	Morning	10000	2/10	Some improvement in BPSD & sleep
Ancoli-Israel et al., 2003	3 group, repeated measures	92	Morning, evening, or dim red	2500	2/18	Some improvement in BPSD
Barrick et al., 2010	Cluster unit cross over with 4 conditions	66	AM BLT, PM BLT, All Day BLT, Standard Light	2000-3000	2/21	Sleep, BPSD
Burns et al., 2009	2 group, randomized clinical trial	48	Morning	1000	2/14	Improved BPSD, depression
Colenda et al., 1997*	Case series	5	Morning	2000	2/10	NS
Dowling et al., 1997	2 group randomized clinical trial	70	Morning, afternoon	>2500	1/70	Sleep. BPSD
Fetveit et al., 2003*	One group	11	Morning	6000-8000	2/14	Improved sleep and some BPSD
Haffmans et al., 2001	Cross over double blind, controlled trial	6	Morning	10000	.5/10	Improved motor restlessness, some increased agitation
Lovell et al., 1995	One group, repeated measures	6	Morning	2500	60/20	Improved agitation
Lyketsos et al., 1999	Cross over randomized controlled trial	8	Morning	10000	1/28	Increased sleep $P < 0.05$; BPSD NS
Mishima, et al., 1994	One group, repeated measures	14	Morning	3000-5000	Sleep, BPSD, melatonin	Improved for all 3 variables ($P < 0.05$)
Mishima, Hishikawa, & Okawa, 1998	Cross over randomized controlled trial	12	Morning	5000-8000	2/14	Improved only for Vasc.Dem. $P < 0.05$

Table 2.3 continued

Articles	Study Design	Total sample	Timing	Intensity Lux	Duration hours/day	Outcomes
Nowak & Davis, 2011*	2 group, qualitative, randomized	20	Morning	12,000	30/14	Carers' perspective of global function improved; control group decreased resistiveness to care
Okawa, Hishikawa, Hozumi, & Hori, 1991*	One group, repeated measures	24	Morning	3000	2/30-60	Improved sleep in 50%
Riemersma-van der Lek et al., 2008	double blind placebo controlled, RCT	189	Whole day or dim	1000		Improved mood, Cognition, BPSDs, melatonin
Satlin et al., 1992	One group repeated measures	10	Evening	1500-2000	2/7	Some sleep parameters improved; BPSD
Schindler et al., 2002*	Case series	5	Morning	2500	2/14	Improved psychotic sx
Skjerve et al., 2004	1 group repeated measures	10	Morning	5000-8000	.75/28	Improved BPSD
Thorpe, Middleton, Russell, & Stewart, 2000*	One group	16	Morning	3000	2/28	improved agitation
Van Someran, et al., 1997*	One group, repeated measures	22	All day	LT room	all day/28	decreased night time activity
Yamandera, Ito, Suzuki, Asayama, Ito, & Endo, 2000	One group, repeated measures	27	Morning	3000	2/28	Increased $P < 0.05$ night sleep; Decreased $P < 0.01$ # time up at night

*=not included in meta-analysis

CHAPTER III

METHODOLOGICAL CONSIDERATIONS IN META-ANALYSIS: EXAMPLES FROM MA OF NONPHARMACOLOGICAL BEHAVIORAL INTERVENTIONS ABSTRACT

Abstract

Scientists concur that one study does not provide complete evidence of efficacy. The cumulative body of knowledge is needed to develop this evidence-base. Meta-analysis developed as the wealth of emerging knowledge grew. Systematic review has a rigorous methodology, but is limited by inclusion criteria and the reliance on the subjective interpretation of findings from the primary study authors. Meta-analysis was designed to eliminate some of the bias of the systematic review process, taking a more statistically sound approach. The purpose of this dissertation is to present the advantages of using the full spectrum of available research, including studies that are small and employ different methodologies, to expand foundational knowledge of new interventions. Using the example of naturally-restorative-environmental interventions, this article presents the case that in order to capture the potential benefits of new behavioral-based interventions are best captured when meta-analyses include more than just random controlled trials.

Introduction

Meta-analysis (MA) developed out of the wealth of emerging knowledge generated by many disciplines. For a long time scientists have known that one study does not make a complete conclusion to a problem or provide very strong evidence of efficacy (Hunter, Schmidt, & Jackson, 1982). A thorough, systematic review of all literature/

research on a topic best discerns options, viability, and responses to various situations, individuals, and co-conditions. Yet, a systematic review will always be limited by the authors' interpretation of outcomes, differences in what is considered systematic, and a reliance on the subjective interpretation of findings from the primary study authors (Borenstein, Hedges, Higgins, & Rothstein, 2009). MA takes the systematic review one step further by limiting the included research to only that which satisfies rigorous statistical criteria. Thus, the MA approach will always omit studies that do not meet the highly rigorous standards of the scientific method. While this approach has important benefits, it should be re-evaluated in the many examples where meeting these criteria is not possible. Indeed, in the real world, often other kinds of studies can offer valuable evidence of efficacy that can inform creative, low-cost, low-risk interventions.

Purpose

The purpose of this paper is to present the case of an inclusive an MA using the MA of naturally restorative environmental (NRE) interventions as an example for these alternatives. The advantages and limitations of including multiple research design methods and the potential for expanding evidence the MA methodology are described. There are limitations and new biases to be dealt with, but the benefits need to be considered while continuing to address the limitations. Meta-analysis was developed to take some of the bias or error out of the process and take a more statistically sound objective approach to systematically reviewing research. MA was an attempt to garner appropriate, effective, grounded solutions, based on more than the "what has always been done" approach to interventions, as well as innovative interventions which are just beginning to accumulate evidence.

All research methodologies contribute to the body of knowledge of a subject, illuminating different facets of the unknown. Nevertheless, many researchers using MA methodology follow the Cochrane criteria, restricting inclusion criteria to certain approaches (randomized controlled trials or RCTs), or rigid methodologies, thus limiting the types of studies included. This is especially limiting when compiling and assessing the results of studies that investigate non-pharmacological interventions for people in real-life situations, such as patients with Alzheimer's disease (AD), because often studies in these populations are not RCTs and have small sample sizes, and therefore are difficult to prove significance.

In the developing area of non-pharmacological interventions in persons with AD, little is known about individual responses to AD, the progression and specific symptoms, and treatment options, both pharmacological and otherwise. To replace the overuse of largely ineffective pharmaceutical treatments, new, innovative treatments are being developed and evaluated for efficacy and effectiveness, often as pilot studies. Therefore, to obtain a systematic comprehensive perspective on options for individualizing disease and behavior management, we need to look beyond the RCT, being inclusive of the knowledge gained from different types of studies.

MA of Interventions Using the Naturally Restorative Environment

A meta-analysis of naturally restorative environmental (NRE) interventions for persons with AD, related to response on disruptive behaviors and on quality of life (QoL), was done to establish an evidence base for future studies. Disruptive behaviors are often classified as "behavioral and psychological symptoms of dementia" (BPSD). MA

methodology was chosen as the types of studies found in NRE research are varied in design, interventions, and outcomes studied; the studies generally have small sample sizes, and no meta-analysis/ meta-synthesis had been done on NRE in people with AD (Bossen, in press). Three main types of interventions using NRE elements were included; aromatherapy (AT; *k*=9), bright light therapy (BLT; *k*=10), and horticulture-based therapy (HT; *k*=14). Findings from this MA showed an effect size (ES), for two-group comparisons, ES = 0.484 $\pm$ .138, p>0.001, (k= 17) favoring decreases in BPSDs with NRE interventions. In single group analysis (*k*=7), an ES= 0.758$\pm$ 0.109, (*p*>0.001) was determined for BPSDs. This indicates that subjects with AD had fewer BPSDs and improved QoL when interventions used elements of NRE. Despite considerable heterogeneity, individual moderators show potential benefits, in a variety of settings, and in different contexts. There was no difference with greater intensity/ frequency of intervention "doses", and effects were similar for group versus individual sessions.

Definition and Description of Meta-Analysis

Meta-analysis (MA) is a rigorous research process that allows an organized way to integrate a large number of study findings. MA is more differentiated and sophisticated than conventional review methods and it can uncover effects or relationships that are obscured or not defined in other summary methods (Borenstein et al. 2009). MA allows identification of grouping moderator variables, determination of effect sizes, and generalizable conclusions from a variety of research designs. Nevertheless, multiple approaches to MA are based on different inclusion criteria, available studies, statistics presented, and disciplines.

Although the definition and process of MA allows for inclusion of multiple design methods and statistics, use of study designs other than RCTs is not common. In assessing the search criteria from nine systematic reviews and MAs on nonpharmacological interventions for people with AD, the inclusion criteria was to use only controlled trials in about half of the reviews. The Cochrane Collaboration was most often cited to evaluate inclusion criteria (Ayalon et al., 2006; Kong et al., 2009; Olazarán et al., 2010; O'Neil et al., 2011; Spijker et al., 2008), which in the MA on NRE would have eliminated a majority of the primary studies. In the MA for NRE, a total 34 studies provided enough statistical information to be included. Of those, 12 were RCTs; 18 were two-group design, comparison or control group; and 15 studies followed the single pre, post design. These restrictions led to consideration of whether there might find ways to tailor the methodology to make the most of the available data.

Benefits of MA

Determines more than *p* values

MA allows scientists to look at more than statistical significance (*p* values) to determine magnitude or clinical significance. In an area such as nonpharmacological approaches to dementia care, (the MA on NRE), this is a crucial distinction. *P* values that are considered significant indicate whether the observed treatment effect is not due to chance alone (McGough & Faraone, 2009); however, the effect may be influenced by factors that are difficult to control, such as sample sizes. Significance is affected by both effect size and sample size (Coe, 2002); indeed, in studies with large sample sizes, significance is easier to obtain (Borenstein et al, 2009).In other words, a small study that has shown highly effective treatment effect, may not show a higher significance than a

large study with a marginally effective treatment. To adequately interpret data, in terms of clinical significance, the direction, magnitude, and relevance all must be considered, but these are not indicated by *p* values alone (Borenstein et al, 2009). Additionally, if an intervention is not shown to be statistically significant, it does not necessarily mean it is ineffective (Orlitzky, 2012). Something may be statistically significant but make little difference clinically, or vice versa. Significance is affected by both effect size and sample size (Coe, 2002).

Allows weighting by sample size

When synthesizing studies in an MA, power can be obtained by mathematically rigorous mechanisms. The statistics from primary studies are used in the formulas of MA. Mathematical manipulation allows different statistical forms to be standardized and then assigned weights based on mathematical criteria to provide a transparent, objective, and replicable synthesis of evidence (Borenstein et al., 2009). It is argued that the essential feature that allows for such meta-analysis, considering these variations, lies in the standardization of effect size statistics (Lipsey & Wilson, 2001). Differences between groups (intervention and control) can be represented by standard deviation (SD) units, allowing these differences to be compared (Lipsey & Wilson, 2001).

Shows magnitude of effect size

Determining the grouped effect size can allow us to look at the magnitude of the effect, which may have relevance in determining clinical choices in treatment options (Borenstein et al., 2009). A feature of an effect size (ES) is that “it can be directly converted into statements about the overlap between the two samples in terms of a comparison of percentiles. An ES is exactly equivalent to a 'Z-score' of a standard normal

distribution. This enables a mathematical translation of ES into clinically relevant and meaningful terms (Coe, 2002). For example, "an effect size of 0.8 means that the score of the average person in the experimental group is 0.8 standard deviations above the average person in the control group, and hence exceeds the scores of 79% of the control group" (p. 3, Coe, 2002).

Knowledge creation/innovation

Allowing for broad inclusion criteria in a MA assists in the identification of emerging methodologies, future research questions, potential variables and confounders, barriers and facilitators, and to develop concepts and constructs, thus leading to innovation (Schmidt, 2008). MA brings together a variety of studies to look at a body of work on a topic and evaluate the relationship between the variables. "The focus of meta-analysis is on the accurate and precise calibration of relationships among variables and constructs (including moderated relationships). Once these relationships have been calibrated, the focus can move to theory construction and theory testing," (Schmidt, p. 97, 2008). Using less restrictive, more inclusive criteria for studies, MAs help to define, refine, and create new and better options based in the perspective of using all knowledge that has been tested. This can be especially true for nursing science, as Conn and colleagues (2003) point out, when inclusion criteria beyond RCTs are used for a more inclusive MA. An example of this is in pilot studies that test innovative interventions or interventions with populations that are difficult to recruit.

Differentiation by moderators

Another benefit of MA is that analysis of variance or multiple regression analysis can be used, when appropriate, to determine if and how subject scores are related to

different variables (Borenstein et al., 2009). Determining if attributes of the sample population, for example, the type of dementia, has a moderating effect on the size or direction of the effect may provide useful insights into appropriateness of an intervention. This provides invaluable insights for potential responses with individualization of interventions.

Barriers in MA

Primary study quality in MA

There is a continuing debate in meta-analysis over quality assessment of primary study inclusion with regard to internal validity and external validity (Balk et al., 2002; Herbison, Hay-Smith, & Gillespie, 2006; Juni, Altman, & Egger, 2001). While internal validity refers to the systematic error controlled by managing bias in a study, external validity refers to the extent to which the findings from a study can be generalized to a larger population (Juni et al., 2001; Walach, Falkenberg, Fonnebo, Lewith, & Jonas, 2006). Many tools have been developed to measure quality; but, so far, there is no agreement on a standard tool. Indeed, there is no agreement that measuring quality is beneficial or detrimental to a meta-analysis (Herbison et al., 2006; Juni et al., 2001). While some researchers say it makes "intuitive sense" to include study quality measures into a MA (Juni et al., 2001), others report findings from an observational study of quality scores, indicating that none of the quality scores appeared to measure quality validly (Herbison et al., 2006). Other researchers found individual quality measures are not reliably correlated with strength of treatment effect across studies; thus not supporting inclusion of quality measures (Balk et al., 2002).

The MA of NRE included a mixed method of integrating quality measures and included studies that had small sample sizes and various study designs. This study defined from the beginning the inclusion criteria and key aspects of quality in primary study methods, thus helping to ensure rigor (Borenstein, et al., 2009; Lipsey and Wilson, 2001). The *a priori* determination of these criteria were tracked in the coding system and used in consideration and interpretation of findings.

The efficacy-effectiveness gap and the role of RCTs

Current literature in health care, and especially in behavioral health, has called increasingly for interventions that work (Kaplan, Giesbrecht, Shannon, & McLeod, 2011; Lagomasino, Dwight-Johnson, & Simpson, 2005; Wells, 1999) not just in highly controlled clinical trials, but in real life situations. Interventions must be effective with real people, in real situations and include the co-morbidities, and complex social, genetic, and unique histories beyond the basic moderators of gender, race, and age. This can prove especially difficult in working with people with AD, for example, as methodologies have to take into consideration the changing nature of the individual's situation. Research studies should not add additional stress by restrictive research protocols that don't allow for individualization of the intervention being tested.

Interventions need to show effectiveness as well as efficacy. Yet, for advances in what are consider "evidenced-based" practices, health care practitioners, educators, and researchers tend to rely exclusively on randomized clinical trials (RCT). The "substantial evidence" requirement appears to have gone the wayside in favor of the RCT. The RCT has been labeled the "gold standard" of research methodology. This approach is now being reexamined. A recently published editorial cites issues with the common

(mis)conception that the RCT, the "de facto" standard, has become the only standard by which quality can be determined. This reference to the scientific community's over reliance on RCTs, "has resulted in a foundation for decision-making in health care that is as unstable as a one-legged stool" (p.1, Kaplan et al., 2011). Other studies point out the often overlooked problems with RCTs of dramatically over estimating effect sizes, and only working with a very select subgroup of people (Herman, 1996; Kaplan et al., 2011).

The hierarchy of designs

Some of the rigid criteria for RCTs are not practicable in all research disciplines (Conacato, Shah, & Horwitz, 2000; O'Connor et al., 2009; Turner, 2005). This is especially true with the emphasis moving toward effectiveness research where concerns are with relevant, reasonable and cost-effective treatments in the clinical setting (Lagomasino et al., 2005). The over-emphasis on RCTs has a historical perspective in the development of the pharmaceutical industry, where RCTs were mandated tests for assuring drug safety. The FDA required by that new drugs had to have at least 2 RCTs that showed efficacy for the drug to be approved (Kaplan et al, 2011). As legal issues arose, the demonstration of efficacy contributed to making the RCT the main and highest standard, but as funding issues and time constraints made the practice unsustainable, this standard was recently relaxed (Kaplan et al, 2011; Wells, 1999). Now, scientists are calling for researchers to keep in mind that all levels of evidence have strengths and weaknesses, and a strict adherence to the RTC model might negate contributions of various, valid designs (Concato et al., 2000; Kaplan et al., 2011; Wells, 1999).

A particularly illustrative example is found in a study where the hierarchy of research methods was challenged, a comparison was made of results of original studies

based on research design (Concato et al., 2000). In five different areas they grouped RCT findings against cohort or case-controlled observational studies to see if there were over or under estimations of treatment effects. Their findings did not conclude any systematic overestimation of treatment effect in observational studies compared to RCTs on the same topics. In fact, the observational studies showed less heterogeneity of results than the RCTs (Concato et al., 2000).

Blinding and randomization

When developing intervention research of nonpharmacological interventions for AD, relying on RCTs to provide the "best evidence" can be severely limiting. The RCT typically randomizes a large number of participants from a homogenous set of patients who undergo comparative treatments over a long period of time, with raters blind to the intervention and what participants are in the intervention group. Some authors have pointed out that, in their search for eligible studies, blinded assignment was usually impossible because participants were in long-term care settings and those doing the interventions were aware of the nature of the intervention because they provided it or were the caregiver (Ayalon et al., 2006; Spijker et al., 2008). However, other researchers suggested that blinding of participants may be achieved because of their advanced stage of AD (Cohen-Mansfield, Marx, Freedman, Murad, Thein, & Dahkeel-Ali, 2012; Ayalon et al., 2006). Still, concerns remain that the rigid characteristics that define the RCT has been expressed by researchers where conditions are compromised by the frailty and age of this age cohort (Cohen-Mansfield, 2000; O'Connor et al., 2009). While acknowledging a need for rigor, they suggest some accommodation is justified in aging care research.

Randomization has limited potential, as restrictions to able, available, and compliant subjects can be transient and subjective. In a study on participation in RCTs for Alzheimer's interventions , only a striking four to eight percent of the available participants met inclusion criteria (Schneider, Olin, Lyness, & Chui, 1997). Additionally, the participants were shown to be better educated, less medically ill, less behaviorally disturbed, declined more slowly, and experienced lower mortality rates than the persons who did not meet the inclusion criteria (Schneider et al., 1997). This kind of bias limits generalizability (external validity), and does not adequately address clinical problems (Juni et al., 2001). In the MA on NRE, random allocation was done in some form, by participant or facility, in 14 of the 35 studies and the participants and/or staff involved were blind to the treatment in only in 8 studies. Reasons for not controlling for these elements were consistent with those cited by others.

Heterogeneity in studies

AD patients are an inherently heterogeneous group since, as yet, no in AD accurate system has been devised to differentiate the types of dementias that affect responsiveness to interventions. For example, in a quasi-experimental study, bright light therapy appeared to significantly ameliorate agitation in patients with vascular dementia, but not patients with other types of dementia (Mishma et al., 1994). However, only two of the studies from the MA of NRE included information on results according to type of dementia, making it impossible to define what kinds of dementia may be responsive to the intervention. In addition, most studies did not include information on gender differences, even the RCTs.

Compliance, time, the environment, and dementia

Acceptable timeframes constitute another hindrance RCT protocol compliance places on AD studies (O'Connor et al, 2009). A common phrase when discussing AD patients is that if you wait awhile, things will change. This refers to the continual decline of patients with the disease process and the mood instability characteristic of AD. Such limitations can translate into "non-compliance" with RCT protocols, impacting the results and efficacy. Over the long term (i.e., the 2-3 year duration of a clinical trial) the status and response of the AD patient may change so dramatically that even if a behavioral intervention worked in the short term, over time the conditions surrounding the behaviors and patient function may alter the findings. This could render the findings inaccurate and potentially not support an intervention that in fact did work. Arguably, strict time windows are of greater consequence for drug treatments, which might come with deleterious physical effects or allergic reactions, but most nonpharmacological interventions have limited side effects.

RCT protocols are also limited because they cannot consider the basis for BPSDs or the changing situations of the long term care environment. These severely limit implementing RTCs for interventions targeting BPSDs, which theoretically are a response to the environment, a mismatch between the fit of a patient with their environment (Lawton et al., 1996), an unmet need (Algase et al., 1996), or because of the diminishing capacity to deal with stress (Hall & Buckwalter, 1987). Any change in behavior may make a research-prescribed intervention an inappropriate choice. Flexibility is usually necessary to tailor interventions to individual resident needs but the rigid controls demanded by an RCT would prohibit such tailoring. This presents a serious

limitation since several authors have found interventions work best if they are individualized to the individual's interest, mood, personality, and capacity (Cohen-Mansfield et al., 2012; Kolanowski, Litaker, Buettner, Moeller, & Costa Jr., 2011). Thus, the rigid treatment protocols in some study designs can even create unethical situations.

The setting of RCTs generally involves a clinic setting or at least an environment that is highly controlled or controllable, with specific dosages given at specific times, when participants are willing and motivated to participate. For many intervention studies concerning the person with AD, the setting is often not controllable. In the case of the NRE MA, looking at the outcome of diminished behavioral responses, attempting to give a treatment to an unwilling, resistive resident may induce fidelity difficulties when attempting to follow a strict protocol. The interventionist might provide a partial "dose" in relatively the same way she/he provides the intervention to another participant, but the fidelity to the protocol is lost. Often, the interventionist is a staff member who has other responsibilities, so may not remember to record the specifics of the intervention and/or outcome (Cohen-Mansfield et al., 2012).

Can this be "controlled" in another environment? Even if the controlled conditions are possible, the clinical relevance is then lost. Intervention studies focus on patients' relevant concerns, while clinically relevant studies focus on symptom burden, quality of life, functioning, life satisfaction, problem attenuation, and caregiver hurdles in ensuring patient safety and security (Lagomasino et al., 2005; Wells, 1999). The clinically relevant concerns are the ones that patients, families, and caregivers find most meaningful.

Behavioral research

The gold standard RCTs often require generous amounts of time, equipment, human resources (in terms of training and instituting the protocols), and human resources to manage all the institutional protocols (Kaplan et al., 2011; O'Connor et al., 2009). Behavioral intervention research has not typically been on the front tier of funded research, thus limiting the resources available for an intervention RCT (Kaplan et al., 2011). One might also question the sustainability. If it takes a research team to carry out an intervention, can the intervention be implemented with the regular staff and no research team?

Quality criteria as inclusion criteria in MA

In reviewing search criteria from nine systematic reviews and MA on nonpharmacological interventions for people with AD, the inclusion criteria was to use only controlled trials in about half of the reviews. The reasons often cited were the recommendations by the Cochrane Collaboration for evaluation of study quality, which included randomization, allocation concealment, baseline comparability (selection bias), blinding of participant and/or providers (performance bias), blinding of outcome assessors (detection bias), reporting of attrition, and use of intent to treat analysis (attrition bias) (Ayalon et al., 2006; Kong et al., 2009; Olazarán et al., 2010; O'Neil et al., 2011; Spijker et al., 2008). The other studies did cite concerns for quality and used a variety of standards: two expressed the need to broaden the inclusion criteria and so modified them (O'Connor et al., 2009; Turner, 2005); and three considered the issue at hand to be nonpharmacological interventions for behaviors, so felt the presence of BPSDs were an element necessary to provide validity when evaluating the outcome of

reduced behaviors (O'Connor, et al., 2009; Olazaran et al., 2010; Spijker et al., 2008). This seems a rather obvious inclusion criterion, but it is not outlined in either Cochrane or APA criteria.

Handling primary study quality in MA

The attention to quality and study rigor is not to be ignored, but the nature of the entity being researched must be considered; in other words, context is relevant (Balk et al., 2002). When, for example, medication efficacy may be the question of interest, the inclusion criteria should be based on RCTs, while less threatening, potentially harmful interventions may include a wider body of knowledge including observational studies (Chambliss & Hollon, 1998). Walach and colleagues (p. 8, 2006) state that "internal validity has to be balanced by external validity, and this can rarely be achieved with one single research method such as the RCT,…methods then should be viewed not in terms of a hierarchy of intrinsic worth but as valuable only relative to the question asked".

Including some determination of study quality is an essential component of a rigorous meta-analysis. Areas where quality can be enhanced begin with the weighting of studies which is generally a function of sample size (Conn & Rantz, 2003). It may also include *a priori* decisions about inclusion /exclusion criteria, literature search and retrieval strategies, and attending to publication bias (Borenstein et al., 2009).

Rigid restriction by inclusion criteria can limit the number of studies and thus important contributions from smaller and innovative studies, often done in nursing research (Conn, 2004). To ensure rigor in small studies, the inclusion criteria and methodology should be defined at the outset (Borenstein et al., 2009; Lipsey & Wilson, 2001). *A priori* determination of these should be tracked in the coding system and thereby

available to use in consideration and interpretation of findings. By integrating the quality measures with the coding system, the items coded may then be used to design empirical questions as to the relevance of the quality measure to conclusions drawn (Conn & Rantz, 2003; Lipsey & Wilson, 2001).

To meet these goals, some authors have developed their own methods for assessing primary study quality (O'Connor et al., 2009; Walach, et al., 2006). Using adapted research other checklists and clinical knowledge of cognition and behavior, O'Connor and colleagues (2009) determined quality measures for their study. Others included that there was an attention control or comparison group, random allocation, replicability, sample size of ten or more, use of outcome measures consistent with the research question(s), some statistics, and/ or blinding if possible (O'Connor et al, 2009). O'Connor justified this as "making allowance for the difficulties that bedevil behavioral research (limited funding, small sample sizes, variable clinical presentations and a lack of blinding to treatment conditions). A need for rigor was tempered, therefore, by an appreciation of the obstacles facing investigators (p. 11, 2009). Other designs, like repeated measures studies (in which all participants act as their own controls), Have been supported as efficient, robust and equitable to rigorous RCTs (Balk et al., 2002; Concato et al., 2000; Juni et al., 2001). Moreover, for non-pharmacological trials in people with marked AD, contamination of the designs by learning effects, treatment "carry over" and disease progression are unlikely to be a problem in the short-term (O'Connor et al., 2009).

Improving inclusion of nonpharmacological studies in MA

Nurses can address quality in their research to prompt their studies to be included in MAs and other systematic reviews. Foremost, nurses must recognize the importance of comparison/control groups in evaluating effective interventions; this is one of the more important features of a well-designed study, where change in outcomes maybe more likely due to an intervention (Kaplan et al., 2011; Concato et al., 2000; O'Connor et al., 2008; Walach et al., 2006). Nurse researchers can also influence how MAs are conducted by accepting a variety of studies, not restricting inclusion criteria and using studies with good quality that are not RCTs. Another way to improve inclusion in reviews is to ensure internal validity thus enhancing study quality. It is critical to strive for conceptual clarity, from understanding and defining concepts accurately, to choosing instruments that are psychometrically sound and validated in a population of people with AD, then clearly defining outcome goals and/or training of the staff/ research assistants administering the tools (O'Connor et al., 2009).

Aside from primary study quality measures, there are options for incorporating study quality into MAs. Authors agree on excluding trials that fail to meet some standard of quality measure (setting a quality threshold) with the criteria for this set *a priori* (Conn & Rantz, 2003; Juni et al., 2001; O'Connor et al., 2009). The first method involves statistically giving weight to studies based on effect size (ES) estimates (Conn & Rantz, 2003; Juni et al., 2001). By basing weight on high quality scores, studies that meet higher standards would be assigned greater impact. Nevertheless, some have pointed out the pros and cons to this method, arguing that it is statistically unjustified (Conn & Rantz, 2003; Juni, et al., 2001).

Another method is to incorporate quality measures as an empirical question (Conn & Rantz, 2003). For example, a comparison of effect size variations between methodologically sound studies to studies with methodological flaws could be done. If the effect size differences are not related to the methodological soundness, then one could include the less rigorous studies (Conn & Rantz, 2003). Doing this allows that the MA can then include all studies that address the research question, maximizing existing data (Conn & Rantz, 2003), a form of sensitivity analysis (Juni et al., 2001). A combination of these methods may also be employed (Conn & Rantz, 2003). The MA on NRE used both the combination method and sensitivity analysis.

Significance of more inclusive MAs

Funding of behavioral treatment studies has not kept up with other areas of research interest, such as drug trials (Concato et al, 2000). This, along with the over-valuation of RCTs, reducing what we learn to *p* values, losing valuable insights from inclusion of different study designs; and perhaps more importantly, it limits funding of primary studies that that do not fit the RCT design. This is a mistake. The interventions using the naturally restorative environment are generally small, novel in design and implementation, and some might say, "exploratory" and innovative. As we found in our MA, early studies may have lacked the scientific rigor of RCTs, and used rudimentary statistics characteristic of the time and discipline in which they were published, but many of these studies made important discoveries. The price paid by not including these studies is the loss of innovative and potentially effective interventions.

Discussion

In the MA of NRE pooled ES were in the mid- to high range, thus showing significance and clinical relevance for both outcomes; BSPD ES= 0.484 $\pm$ 0.138, (p>0.001); QoL ES = 0.758 $\pm$ 0.109 (p>0.001). These data suggest NRE interventions for AD patients diminished BPSDs and improved QoL. Despite considerable heterogeneity, individual moderators showed potential benefits, in a variety of settings, and in different contexts (See Bossen, in press).While positive outcomes were found in the MA of NRE there was considerable heterogeneity. The outcomes, demonstrated by the pooled effect size, the variances and dispersions, and the moderator variables, may explain across-study variance or may result from the inclusion of a wide variety of studies (Aguinis, Pierce, Bosco, Dalton, & Dalton, 2011).

What is important from this MA is the knowledge gained about potential responses, uses of NRE, and detailed information about what has and has not been studied. For example, the studies in this MA were done mainly in long term care populations of persons with AD in later or severe stages. The use of NRE in earlier stages of AD has not been tested. Behaviors are one of the reasons for early and some may say premature institutionalization. There is evidence that NRE improves quality of life and provides an activity that benefits both the caregiver and person with AD (Smith et al., 2005); but in the literature found, no study has looked at persons in earlier stages or mild cognitive impairment (MCI). There is no indication if the use of NRE before placement may attenuate behaviors thus forestalling institutionalization. This provides a basis for future research grounded in the findings form the more inclusive MA.

Findings from the NRE MA identified important characteristics of effective NRE interventions (e.g. type of NRE, aromatherapy versus bright light therapy versus horticulture therapy). It provided a beginning understanding of the moderating effects that variables such as dose and setting (nursing home vs. assisted living) will be important for informing the design and application of future NRE interventions. The use of NRE interventions may provide inexpensive, desirable strategies that have no or limited side effects. As dementia care moves toward more evidenced-based practices, pooling results to determine the most robust treatment effects for behaviors and QoL is essential.

Clearly, much is lost if we respect only RCTS, *p* values; this is not trivial. Such limitations cost the patient, and eliminate the chance to benefit from potentially effective, and usually nonpharmaceutical, interventions. It is time to recognize that through an inclusive MA, knowledge can be retrieved from many sources (Aguinis et al., 2011). MA is not perfect; perfect primary studies do not exist, even if they are RCTs. Inclusive MA criteria allows for a broader array of studies from which to draw the effectiveness of the interventions and is a good method for nurse researchers to use in studying non-pharmacological and other behavioral interventions.

CHAPTER IV

THE EFFECTS OF THE NATURALLY RESTORATIVE ENVIRONMENT FOR PERSONS WITH DEMENTIA: A META-ANALYSIS

Abstract

The naturally restorative environmental (NRE) can affect people's health, well-being, and quality of life. For persons with dementia, NRE interventions have demonstrated a variety of benefits: decreased agitation; less use of psychotropic drugs; enhanced sociability; and self-reported improvements in well-being, quality of life, and engagement in meaningful activities have been documented. Despite the potential of NRE interventions, the research to support them has not been synthesized and defined in terms of specific behaviors that may be affected and moderating variables. The purpose of this paper is to determine effect sizes through a comprehensive meta-analysis of the studies that detail the use of NRE interventions (aroma-, bright light-, and horticulture therapies) for behaviors and QoL in dementia care. Random effect models, in two group design studies, showed decreasing agitated behaviors ES= 0.484 $\pm$0.138, CI= (0.215, 0.754), p >0.001; and for QoL ES= 0.579 $\pm$ 0.171, CI= (0.243, 0.915), p =0.001.

Introduction

Alzheimer's disease (AD) is a form of dementia associated with disturbing and disruptive behaviors that account for many negative health and well-being outcomes, including declines in functional status, social engagement, and physical activity (Lyketsos, 2007). The disruptive behaviors typical of AD lessen a patient's quality of life and increase caregiver burden (O'Brien et al., 1998). Many approaches have been used to intervene, but managing AD symptoms remains complex and challenging (Logsdon et al.,

2007). Studies of non-pharmacological interventions for moderating negative behavior, improving quality of life, and optimizing the health of AD patients demonstrated that multimodal, sensory stimulation therapies do offer some benefit (Riley-Doucet, 2009; Schoefield, 2002; Van Deipen et al., 2002; Ward-Smith et al., 2009). Naturally restorative environmental interventions (NRE) stimulate one or more of the senses using natural things: elements of the earth that are living and animate, geographic, or solar and climatic (Gibson et al., 2007). Examples of these would include aromatherapy, bright light therapy, and horticulture therapy. For persons with dementia, interventions that incorporate NRE elements have demonstrated a variety of benefits, including decreased agitation; less use of psychotropic drugs; normalization of the circadian rhythm; and enhanced sociability, affect, cognitive capacity, and attention (Detweiler et al., 2008; Colenda et al., 1997; LaGarce, 2002). Self-reported improvements in well-being, quality of life, and participation in meaningful activities have also been documented (Collins & O'Callaghan, 2008; Duggan et al., 2008; Nowak & Davis, 2011).

Thus, NREs might provide caregivers a way to meet physical, spiritual, psychological, and social needs, while at the same time, improving behavior. Despite the rich potential of NRE interventions for treating dementia, the research to support NRE use has never been synthesized and defined in terms of specific behaviors that may be affected, their dosage, the optimal NRE settings, and other specific characteristics. Further investigation is needed to develop the most effective interventions to take advantage of the widespread benefits of NRE therapy.

Background

Developing evidence for innovative interventions

Psychotropic drugs, which have been the first-line treatment for dementia patients' disruptive behaviors, were recently given a "black-box warning" for potential deleterious complications and little benefit (CMS, May 30, 2012), highlighting the attractiveness of non-pharmacological interventions such as NRE therapy. The healing properties of nature have been recognized since ancient times, because exposure to nature can profoundly affect health, well-being, and QoL. Despite the rich potential of NRE interventions for managing dementia, the research to support NRE use has never been synthesized and defined in terms of specific behaviors that may benefit the NRE dosage, the optimal NRE settings, etc. Further research is needed to optimize the use of NRE and take advantage of its potential benefits for AD patients.

Persons with AD progressively lose their physical and sensory abilities and most receive decreasing exposure to the natural environment. For this reason, although the intervention must accommodate the level of dementia, it should be as authentic as possible and stimulate as many senses as possible. This justifies including a variety of different therapies, each with a basis of NRE elements: aromatherapy with essential oils, bright light therapy at levels consistent with natural light, and horticulture therapy based around cultivating plants. For the purpose of this meta-analysis, an NRE experience includes: 1) passive interactions, such as watching birds through the window, sitting by a light box, listening to bird sounds on a recorder; or 2) more active approaches, for example, indoor or outdoor planting and gardening, walking along a path, doing chair exercises in a sunroom, or animal-assisted therapy. Regardless of how the exposure

occurs, it should ideally offer multisensory stimulation and in physical, emotional, behavioral, psychological, spiritual, and/or cognitive domains.

The literature on NRE intervention for AD is not particularly cohesive. Numerous reviews systematically examined several NRE interventions as part of a study of non-pharmacological interventions for behavioral and psychological symptoms of dementia (BPSD) and some recently reviewed NRE interventions in general, but none exclusively reviewed NRE for AD (Annerstedt & Wahrborg, 2011; Detweiler et al., 2012). In general NRE-intervention studies tend to be small, most are not randomized clinical trials, and most do not fit standard inclusion criteria for strict Cochrane-type meta-analytic methods (Burgio et al., 1996; Connell et al., 2007; Whall et al., 1997). The literature does contain meta-analyses on bright light therapy and aromatherapy, but no research syntheses or meta-analyses has broadly evaluated NRE modalities for persons with dementia.

Interventions that incorporate NRE elements appear to offer a variety of benefits for dementia patients, including decreased agitation, less use of psychotropic drugs, normalization of the circadian rhythm, and enhanced sociability, affect, cognitive capacity, and attention (Detweiler et al., 2008; Colenda et al., 1997; LaGarce, 2002). Overall, studies of NRE interventions for persons with AD showed promise in areas such as sleep, quality of life, and behavior, although some reviews, such as the Cochrane review concerning light therapy, revealed conflicting or inconclusive results (Forbes et al., 2009). Since a wide variety of treatments fall under the umbrella term NRE and various approaches are used for delivering them, evaluating the literature and coalescing the data provokes questions regarding methodology, issues with treatment fidelity, and whether the limited effects are due to small sample sizes.

Literature reviews have compiled study results on the two most popular NRE methodologies, bright light (BLT) and aromatherapy (AT), both therapies were reviewed by Cochrane (Forbes et al., 2009; Holt et al., 2003), but few focused on AD patients specifically. No specific reviews were found on HT. Overall, these reviews concluded that the methodological rigor is often inadequate for making definitive claims. The limitations are illustrated by the Cochrane reviews for both AT and BLT, which found so few studies satisfied their methodological rigor that they based their comments on only one study for AT, and three for BLT. Two reviews did contain sections examining the literature on NRE interventions for AD (Annerstedt & Wahrborg, 2011; Detweiler et al., 2012) and found consistent reports that NRE relieved BPSD and improved QoL in populations of elders with AD.

To optimize NRE interventions for AD, healthcare professionals need to tailor approaches to various settings, changing modalities, dosages, and intensities accordingly. This meta-analytic review aims to compile the available evidence use to guide development of tailored interventions that are evidenced-based.

Theoretical foundation

Theoretically, NRE stimulation engages the elderly by exercising their powers of cognitive reserve, and improving their neural plasticity and attention restoration. This model is in accordance with the biophilia theory of Edward O. Wilson (1984) that claims humans are biologically connected to all natural things. Two major models have developed around this premise: 1) The “Attention Restoration Theory” (ART), derived from the idea that humans have a physiologic (neurological) and psychological response to nature (Kaplan & Kaplan, 1989); and 2) the “stress recovery theory,” which describes

a similar theoretical model (Ulrich, 1984). Both models link the positive effects of nature to the stress-reducing effects of a natural environment, as compared to urban or built environments. Multiple studies find experimental evidence backs this model (Korpela & Hartig, 1996; Herzog et al., 1997; Herzog et al., 2003; Kuo & Sullivan, 2001; Ottosson & Grahn, 2005).

The mode of action of the NRE has also been the subject of speculation (Kaplan, 1995; Kaplan & Kaplan, 2003). Theoretically, interacting with nature arouses a passive fascination in a person's mental state. This mental state of fascination is thought to have the power to restore an AD patient's ability to focus their attention and promotes cognitive reserve.

Purpose

This study is a meta-analysis (MA) of interventions that used the naturally restorative environment (NRE) to treat elderly, dementia patients. The NRE interventions are targeted at behavioral and QoL symptoms. Published and unpublished studies were included. Moderator variables were analyzed by meta-regression to determine effects on the outcomes and the characteristics of various types of programs synthesized. The moderator analysis and meta-regression include concepts such as the specific type of NRE, setting, and level of AD (the type of dementia was generally not collected). When the data is available, duration and frequency will be considered.

Ultimately, this meta-analysis aims to establish combined effect sizes for 1) impact on agitation, regardless of setting and 2) impact on well-being/quality of life, regardless of setting. It will also include a moderator analysis to evaluate characteristics such as dosage, type of NRE, setting and, if possible, the level of dementia.

To inform the design and application of future NRE interventions, it is important to understand how variables, such as intentionality of application, setting (home vs. assisted living), stage and/or type of dementia, influence treatment effect size. Findings from the study proposed here should identify important characteristics of effective NRE interventions: 1) individualized plans; 2) passive versus active engagement; 3) dosages per session and per week; 4) specific NRE interventions; 5) adaptations used; 6) indoor versus outdoor; 7) behavior or outcome targeted; and if possible, 8) the type and/or stage of dementia. Over the long-term, this study should help sensitize nurses and other care providers to both the importance of NRE interventions for people with AD and the role these experiences play in care, well-being, and quality of life of their patients. This knowledge can assist people directly involved in designing physical environments for people with AD, as well as those making policy guidelines to include the NRE when planning new facilities and programs for persons with AD.

Methods

Sample

This search was exhaustive, designed to net as many studies as possible. Electronic searches of the CINAHL, PubMed, Ageline, ProQuest Dissertation and presentations, PsychInfo, Abstracts in Social Gerontology, ERIC, and Google Advanced Scholar databases were conducted under the guidance of a library science professional. Searches included articles published from 1980 through December 2012, since no studies were expected before 1980. The search strategy was designed to retrieve certain data: population characteristics, specific behavioral issues, outcome characteristics, and intervention characteristics. Key search terms included variants of the disease, such as

Alzheimer's disease, AD, or cognitive impairments; specific behaviors like agitation, aggression, wandering; the outcomes terms, behavioral and psychological symptoms, and quality of life, mood, engagement, and well-being; interventions like horticulture therapy, aromatherapy, bright light therapy, non-pharmacological, and AD management. These searches were combined, then narrowed by adding limits, (i.e., AND not child AND not adolescent AND not caregiver). The citations were reviewed by titles and type of publication (i.e., commentary, editorial, non-research), which further refined the list of possible eligible studies. As the pool got smaller, abstracts were read to identify eligibility criteria, (i.e., appropriate population, size of sample, and outcomes).

To include key articles addressing interventions for persons with dementia, searches included gray literature, like dissertations was done with the ProQuest database, an international interdisciplinary repository of conference presentations, dissertations, and theses. Ancestry searching was done by reviewing the citations and bibliographies from eligible studies, protocols and guidelines. The names of first authors of eligible articles were added to searches to identify any other relevant work. Four frequently published authors in NRE studies were contacted to inquire about their or their students' current studies. Conference presentations, journal contents, and abstracts were searched for the same time frame (i.e., *Activities Director Quarterly, Actae Horticulturea*, and *Journal of Housing for the Elderly)* (see Table 4.1).

Inclusion criteria

The sample included all studies that reported adequate statistical information along with the following:

- The application of an NRE in the intervention, including but not limited to natural sounds (e.g., water or bird sounds), deliberate encounters with natural objects (e.g., plants) introducing natural smells (e.g., lavender). Also included were building modifications that introduced natural lighting, views of nature/outdoors, or a garden.
- The outcome measures included agitation, either verbal or physical agitation, and/or measures of quality of life (QoL) and well-being. The former measured by an established instrument, not determined from anecdotal responses; and QoL provided by either the AD patient or the caregiver.
- Study participants had probable or suspected AD or a formal diagnosis of AD or were residents of either an AD-specific or a special care unit. Studies done in nursing homes were included because 60-80% of NH residents are reported to have some form of dementia (Lyketsos et al, 2007).
- Qualitative studies were included if they measured outcomes of agitation or QoL, and/or the data could be transformed into quantifiable numbers.
- A study needed to include at least five subjects.
- Any study design was included as long as it the data met the criteria outlined above.
- The published article had to have been written in English.

The studies included had measured various forms of physical and vocal behaviors that met the conceptual and operational definitions of agitation. For clarity, the term "disruptive behaviors" was used as a general descriptor representing all BPSD unless specified otherwise. Disruptive behaviors, measured by tools specifically designed for the

purpose, were included: the Cohen-Mansfield agitation inventory (CMAI) (Cohen-Mansfield & Billig, 1986), the Neuropsychological Inventory (NPI) (Cummings et al., 1994), BEHAVE-AD (Reisberg et al., 1987), and the Social Dysfunction and Agitation Scale (SDAS) (European Rating Aggression Group. 1992). In addition, we included studies that used behavior checklists, like the Dementia Care Mapping observation (Bradford Dementia Group, 1997) (See Table 4.1).

Until recently, for the AD population, quality of life has not been measured with valid and reliable tools (Scholzel-Dorenbos et al., 2007). Therefore, concepts and constructs that are part of the broader concept of QoL and wellbeing were accepted as a general indicator of QoL. Included as proxy measures for QoL were mood, affect, social interaction, engagement, fall severity, wellbeing, and *pro re nata* (prn) medication use. Tools developed for measuring QoL included the Apparent Affect Rating Scale (Lawton, Kleban, Dean, Rajagopal, & Parmelee, 1992), the Menorah Park Engagement Scale (Judge et al., 2000), Life Satisfaction Index (Russell, 1996), the UCLA Loneliness scale (Russell, 1996), Touch Panel Dementia Assessment Scale (TDAS) (Rosen et al., 1984), Blau QoL scale (Blau, 1977), Revised Social Provisions Scale (Russell, 1996), Perceived Well-being, Life Attitude Profile (Reker & Peacock, 1981), and the Pittsburg Geriatric Center Morale scale (Lawton et al., 1996).

Exclusion criteria

To gain the breadth of content desired, exclusion criteria were limited. Animal-assisted therapy studies were excluded because they introduced an element of living reciprocity that is not present in the other types of sensory stimulation considered. Also excluded were severe psychiatric co-morbid conditions (e.g., schizophrenia).

Data Management

Coding fidelity: A coding scheme was derived from primary studies of outcomes, subjects, methods, interventions, and characteristics of sources. Coding was done by the author and another trained coder. Training involved developing the coding scheme, then pilot testing 23 studies. The two coders (author and trainee) worked independently to code articles until 90% agreement was reached. Coding was audited on five percent of the coded copies and discrepancies were discussed until agreement was reached.

When coding was finished, 34 articles had adequate statistics for final inclusion and were entered into Comprehensive Meta-Analysis (CMA) software (CMA, 2013).

Analysis

Formulas for standardizing the metrics were imbedded in the CMA software used for this analysis. Studies with larger sample populations are weighted by the statistical program to correlate with their increased influence on ESs. Data were collected from the studies and entered into statistical software (CMA, 2013), to estimate the pooled effect size. Residuals, variances, and confidence intervals were evaluated and, if they were unusually wide, then sensitivity analysis done post hoc.

Variation at the study level was anticipated in this meta-analysis. Estimates from fixed- and random-effects models on two-group design were not similar when heterogeneity tests were assessed with Q (52.12, BPSD and 40.397, QoL) and found to be significant ($p>0.001$, $p=0.001$, respectively). I^2 values (73.13.9, BPSD and 77.721 QoL) were moderate, indicating 73% and 78% were due to heterogeneity rather than to chance. Hence were chose a more conservative random effect model.

The analysis was performed in several iterations. Primary analyses were performed for the two distinct methodological designs, one using data form the studies with two-group methodology the other used studies that lacked a control or comparison group. The outcomes, BPSD and QoL, were run for each study design. This was followed by regression analysis using the types of NRE (i.e., aromatherapy, bright light therapy, and horticulture therapy) as moderators for each design condition (one or two group) and outcome (BPSD or QoL).

To estimate "dose", numerical values were designated by frequency, intensity, and duration then categorized as high, medium, or low. Frequency was determined as how often in the period of time, for example, daily. Intensity referred to the length of time the intervention took, like 30 minutes of bright light therapy. Duration was the total number of weeks the intervention took place. These were given numeric values and totaled to equal a "dosage." Although some "doses" didn't fit these parameters, this approach provided a way to use dose as a moderator in the analysis.

Publication bias was evaluated in several ways. Statistical testing by funnel plot looks at sampling error, so larger studies group more tightly at one end because larger studies have less sampling error. Smaller studies, with larger sampling errors, should scatter broadly around the mean ES. A symmetrical funnel-shaped plot then suggests bias is absent (Lipsey & Wilson, 2001) (see Figure 4.2). Sensitivity analysis included several variables but did not affect outcomes.

Results

In total, 34 studies provided enough statistical information for the meta-analysis. Three types of NRE-intervention were represented: aromatherapy (AT; k=9); bright light

therapy (BLT; *k*=11); and horticulture-based therapy (HT; *k*=14). Of those, 12 were RCTs; 18 were two-group design (i.e., comparison or control group), while 15 studies used a single pre, post design. Twenty-five studies specified BPSD as an outcome of interest, while 14 looked at QoL. Six studies had outcomes for both BPSD and QoL. Other outcomes in the individual studies included sleep, cognition, functional ability, cortisol levels, falls, and antipsychotic medication use.

Pooled data yielded effect size (ES) estimates and summary statistics for two outcomes (disruptive behavior and QoL) along with moderator analysis, by type (see Table 4.2). BLT benefits were not significant and subjects treated with greater intensity/frequency had similar effect sizes as those treated with lower "doses." Heterogeneity for single-group designs was significant (p> 0.001), and with a dispersion lower than two-group designs (Q= 4.653, df= 6). Testing of the null hypothesis for BPSD showed a Z= 3.519, p >0.001, rejecting the null hypothesis that NRE interventions do not impact the behaviors for persons with dementia. For the outcome QoL, the Z= 3.381, p >0.001, also rejecting the null hypothesis that NRE does not affect the QoL for persons with AD (see Table 4.3).

MA characteristics

In the pooled sample, 59.85% of the participants were female. Mean age of participants (83.54 years) was based on 32 studies reporting mean age or range of age. Race was mentioned in 32 of the studies, though several studies were conducted in other countries, such as China, Korea, Iran, or Japan, so ethnicity/race was skewed and not used in this analysis. No studies provided results by gender or level of AD. One BLT study (Mishima et al., 1998) did moderator analysis with type of dementia, finding that

those with vascular dementia responded better than participants with Alzheimer's-type dementia.

Pooled group sample sizes were 852 in the treatment group and 500 in the control group, with a median of 24, range 6-73. Eight studies measured type of dementia and 23 studies had the presence of agitation in participants as part of their inclusion criteria. Random allocation was done in some form, by participant or facility, in 14 of the 33 studies. Concealment or blinding of participants and/or staff was reported only in 8 studies. Quality measures, like randomization and blinding, are presented, but not used (for rationale, see Balk et al., 2002; Conn & Rantz, 2003).

Two-group analysis

The two-group analysis of interventions that combined NRE to relieve agitation yielded an ES of 0.484 $\pm$ 0.138, indicating a medium effect (small l=0.20; medium= 0.50; large=0.80) (Cohen, 1988). Confidence intervals (0.215, 0.754) show that 95% of the time the mean will fall in this range of scores (Borenstein et al., 2009). The narrow CI indicates low variability or greater precision (Borenstein et al., 2009). For the QoL outcome, in the two-group analysis, combined NRE interventions yielded an ES of 0.579 $\pm$ 0.17 and a narrow CI (0.243, 0.915), which is similar to the scores for agitation. In the outcome of BPSD, the Q is moderate (low= 25%, moderate=50%, high=75%) (Higgins, 2008) (52.120) and df = 14, which reflects the excess variability attributable to true effects of studies. I^2 (73.139), a proportional value, is moderate to high indicating that a moderate to high proportion of the observed variance is real. Nevertheless, since T^2 = 0.194 (Tau= 0.441) the effects are not dispersed over a wide range.

Intervention characteristics

Aromatherapy

Aromatherapy was done with essential oils, with a specified amount administered on a cotton cloth attached to patients' clothing (n=3). AT was administered for various amounts of time, some for two hours at a time while others were exposed all day long and scent replenished every 2 to 3 hours. One study attached an oil-infused cloth on residents 20 minutes before a medication was administered, and then monitored the resident for resistiveness to care. This was done for a total of twelve applications, 4 of 3 different oils and a placebo. In one study oil was administered via a bedside infuser, so exposure continued overnight. Another study dispersed fragrances via a fan with an oil-infused cloth attached.

Two studies combined hand or hand and face massage with the use of essential oil lotions—a technique typical for aromatherapists. Fragrances used included lavender, *Melissa officinalis* (lemon balm), sweet orange, rosemary, tea tree, thyme, and calendula as a placebo. Intensity was from once to several times daily. Duration varied from once to 52 weeks, with an average of two months. Residents were passive participants, and generally had AT while alone or interacting with the staff who applied the lotion. Very few reported side effects, though some reported skin irritation. Dosage did not impact AT, as *p* values and ES were slightly higher.

Bright light therapy

Bright light therapy (BLT) did not show a significant ES for either outcome, and had a large amount of variation. The most common dose was for 30 minutes, 2 hours a day, in front of a light source. Lux emission from the light source varied from 1000 to

12,000, over 5 to 60 days. One study installed a light fixture in several NHs and studied residents up to an average of 2.5 years. The BLT was tested at different times of the day, reflecting differing theoretical basis for the study design. Some used the light treatment during the morning hours, others during the afternoon. Generally a dim red light was used as the placebo. Only one study used outdoor natural lighting that was supplemented with a light box if the recorded amount of light received per day fell short of a set minimum.

Activity level for BLT was generally passive except for one study, which had residents participating in outdoor activities to get bright, natural light. This is the only study where residents may have interacted with others, though it was not planned as a group activity. Side effects reported included headaches and dry eyes or eye irritation from the lights.

Horticulture therapy

HT included a variety of activities concerning vegetables and flowers (e.g., discussions, planting, tending, harvesting and watering) but findings were mixed. Only two studies used group design. QoL improved significantly in both one and two group designs. Four of the studies included indoor and outdoor activities, depending on the weather. In some instances, groups or individual residents tended plants several times a day or week. Several (k=4) other the studies used a group gathering to have gardening instruction, with hands-on sessions where they actively worked. In another HT approach, two studies used pre and post-test design where the facility had put in a garden and they measured agitation the year before and after installation of the garden.

Discussion

Effects of AT and BLT were smaller than for both outcomes if HT was factored in as a moderator. This could reflect the issue of behaviors being a result of boredom; indeed, the HT interventions are more active and participatory, while both BLT and AT are passive and individual. HT meets the criteria of the attention restoration theory of Kaplan and Kaplan (1989), which posits that to restore attention fatigue the patient must have: 1) a feeling of "being away"; 2) a sense of fascination; 3) extent; and 4) compatibility (1984). Being away is provided through the NRE activities that are beyond the routine of daily life, allowing the mind to be distracted from regular activities. Nature allows for cognitive structures to find interest and capture attention easily in the colors, patterns, and textures of plants and other natural things. This type of "soft" fascination stimulates involuntary attention rather than directed attention, thus rejuvenating cognitive resources (Kaplan, 2001). This is a key feature because as long-term care facilities often substitute TV for other activities. TV watching has rapidly changing visual and auditory stimulation, though is thought to drain energy rather than promote restoration (Csikszentmihalyi, 1990). Extent involves the idea that a person can interact with their environment that makes sense. This coherent environment provides an opportunity to not feel lost or become confused as plants and the natural environment are a common experience from early in life. Compatibility refers to individual interest and preferences.

Reminiscence has been used as an AD intervention for improving mood and cognition (Woods, Spector, Jones, Orrell, & Davies, 2005); and although the AD patient often cannot identify the reason why, the remembrance of a scent, sunshine, or interaction with plants may elicit for them a restorative or positive emotion. Study results provide

evidence that mood states persist even when an individual forgets the antecedent to the emotion (Feinstein, Duff, & Tranel, 2010). This illustrates the importance of the moods that are elicited from interactions. Many of the horticulture therapy (HT) interventions argue that the memories elicited by plants, environments, and outdoor activities are part of the benefits of HT. Nature provides multiple and changing stimulation allowing one to choose to become engaged, as a way to dissolve boredom (Hartig & Staats, 2006). Tending to plants or gardens immerses the person in the larger environment. Engagement in meaningful activities provides the sense of belonging and purpose that is often lost in AD. QoL should improve because NH patients gain a sense of autonomy when they begin to view the NRE intervention as an opportunity to enjoy excursions from the facility.

These findings document that NRE interventions, especially when types of sensory stimulation is combined, ameliorate AD symptoms, relieving disruptive behaviors and improving patients' quality of life. Occurrence of disruptive behaviors is known to correlate with QoL. If disruptive behaviors were to decrease, then QoL should improve (Samus et al. 2005; Samus et al. 2006). It is notable that, when tested individually, some of the various types of NRE did not demonstrate significance, though this may be due, in part, to the limited number of studies. For example, in the two-group design of HT, only two studies could be pooled and analyzed. This supports the idea that to be more effective, more than one of the senses must be stimulated. In moderator analysis, looking across analysis by study design, many ESs were in the mid- to high range, thus showing significance and clinical relevance for both outcomes. As the participants were consisted primarily of people in the later stage of dementia residing in

long term care, NRE provides an important intervention to improve the lives and diminish disruptive behaviors.

Limitations

That this meta-analysis included a variety of study designs and study quality might be viewed as a limitation. Also, many studies lacked a control group, a research tool often cited as a critical for scientific rigor. Many studies included used small sample sizes may limit the findings. The use of small sample sizes in individual studies makes finding significance difficult; the same is true even when these small sample sizes are pooled. Despite these shortcomings, many of the studies compiled included important information and offer a starting point from which to develop NRE interventions in persons with dementia.

Additionally, it has been hypothesized that residents in NHs are bored and lonely; therefore, any type of intervention would provide some additional attention, potentially confounding results of the intervention being tested. Several studies have indicated that physical activity boosts the potential effects of any intervention, so adding this aspect in the HT moderator may influence outcomes.

A more in depth moderator analysis would have made findings more descriptive, had enough data been available to look at different characteristics. For example, the severity of AD and the various NRE interventions are potential moderators. As found in this meta-analysis, most participants were in late stages of the disease, making it impossible to discern whether NRE treatment might have different effects depending on the stage of disease. As evidenced by the Mishma study (1998), the patient's type of dementia affect their outcome, so the type of dementia would provide an interesting

moderating variable to analyze; however, this information was rarely included in the reports we found. As research in NRE progresses, these types of moderators need to be included in study designs.

Conclusions

In summary, while there was some variation according to moderator variables, this meta-analysis determined that NRE interventions are effective for both diminishing BPSD and improving quality of life for persons with dementia. The combined effects of the types of interventions are significant, though for example, BLT does not show significance for moderating BPSD or QoL when analyzed independently. As such, environments of NHs should incorporate natural enhancements (such as ambient lighting or light fixtures that produce adequate lux) and garden space with staff educated and oriented to include outdoor time for residents. These provisions may not only assist with behavioral issues, but will improve residents' quality of life.

To advance this area of research, scientists must improve study design, specifically by including control/comparison groups, and creating standard study protocols for the individual therapies. In BLT studies, for example, the lux, blue-green spectrum, and time of day should be standardized to allow for better comparisons. If AT is specific to an individual, the "assessment" and prescriptive plan should be detailed so future research can replicate study protocols. Additionally, in any of the types of interventions, stricter controls must be observed in medication management to control for confounding effects of the antipsychotic and antianxiety medications administered during studies. Finally, in future studies, a cost/benefit analyses must also be included to inform

readers of the additional personnel and supplies needed to implement the interventions as intended.

The theoretical model of attention restoration theory supports NRE. This model contends that restoring a person's ability to hold their attention reflects real neural regeneration in the brain. If the effects of NRE are generalizable to different stages of the disease, then they might have a greater effect at retaining/improving cognitive capacity if initiated at earlier stages of disease. Indeed, two studies (Sakamoto et al., 2012; Riemnersma-van der Lek et al., 2008) looked at cognition as an outcome and both found positive outcomes for different cognitive capacities. In support of this idea, substantial evidence shows that environmental enrichment, also termed cognitive enhancement, contributes to central nervous system function (cognition) by promoting neural plasticity (Hertzog, Kramer, Wilson, & Lindenberger, 2008). Future NRE studies must evaluate outcomes related to cognitive functioning, especially in early stages and mild cognitive impairment (MCI) when functional and cognitive abilities are less compromised. Maintaining function and improving cognition would have a great impact on the potential to maintain functional abilities, QoL, as well as keeping persons at home longer in a safe environment. These important outcomes need to be incorporated into future research.

Table 4.1. Article summaries

1st Author	Type of NRE	Study design	n= T/C group	Outcome studies	Instruments used to measure outcome	Setting
Alessi et al, 2005	BLT	RCT	62/56	BPSD & QoL	Obs. BSPD	NH
Ancoli-Israel et al, 2003	BLT	RCT	31/31	BPSD	CMAI	NH
Ballard et al, 2002	AT	RTC	36/36	BPSD& Qol	CMAI & NPI & Barthel index	NH
Barnicle et al, 2003	HT	Quasi-exp pre post	31/31	Well-being	Affect Balance scale	NH
Brown et al, 2004	HT	Quasi-experimental pre post	33/33	QoL, well-being, ADLs	UCLA loneliness scale, Revised Social Provisions Scale	NH
Burns et al, 2011	AT	RCT	38/39	BPSD & QoL	PAS, Barthel, NPI& Blau QoL	NH
Burns et al, 2009	BLT	RCT	22/26	BPSD	CMAI	NH
Collins et al, 2008	HT	pre post	18/NA	QoL	qual.	AL
Connell et al, 2007	HT & BLT	pilot comparison	10/10	BPSD, Sleep	CMAI	NH
Detweiler et al, 2008	HT	post occupancy	28/NA	BPSD, QoL	CMAI, Mood, falls, prn med use, tracked garden use	NH
Dowling et al, 1997	BLT	RCT	29/17	BPSD	NPI	NH
Fujii et al, 2008	AT	RCT	14/14	BPSD	NPI, Barthel Index	NH
Gigliotti et al, 2004	HT	comparison to other activities	14/NA	QoL	engagement & mood, DCM	ADS
Gigliotti et al, 2005	HT	comp activities	48/NA	QoL, engage-ment & affect	DCMapping	ADS
Gray et al, 2002	AT	Obs	13/NA	BPSD	Obs	NH
Haffmans et al, 2010	BLT	pre post cross over	10/NA	BPSD	Social Dysfunction & Ag. Score	NH
Heliker et al, 2000	HT	pre post	24/NA	QoL, well-being; Meaning	Perceived Well-being, Life Attitude Profile	Sr center & Botanicg-arden

Table 4.1. continued

1st Author	Type of NRE	Study design	n= T/C group	Outcome studies	Instruments used to measure outcome	Setting
Holmes et al, 2002	AT	RCT	15/15	BPSD	Pitt Ag Score	NH
Jarrott et al, 2010	HT	Mixed methods; comp activities	75/54	QoL engage-ment & affect	Apparent Affect Rating Scale & Menorah Park Eng., Scale	ADS & NH
Jarrott et al, 2002	HT	pre post	9/NA	QoL, engage-ment	obs. For activity and affect (DCMapping)	ADS
Jimbo et al, 2009	AT	pre post cross over	28/NA	cogn fxn; QoL	TDAS	NH
Lee et al, 2008	HT	pilot repeated measures	23/NA	BPSD & Sleep, cognition	CMAI. Actigraph,	NH
Lin et al, 2007	AT	RCT; cross over	35/35	BPSD	CMAI & NPI	NH
Lovell et al, 1995	BLT	pre post; ABABA design	6/NA	BPSD	Bliwise Agitation Behavior Rating Scale	NH
Lyketsos et al, 1999	BLT	Randomized, Cross over	15/NA	BPSD	BEHAVE-AD	NH
McMinn et al, 2000	HT	pre post	13/NA	BPSD; prn drug use	Disruptive behavior scale, prn med use	Geropsych unit
Mishima et al, 1994	BLT	Quasi-exp. Pre-post	14/10	BPSD	Obs. BSPD/	Geropsych unit
Riemersma-van der Lek et al, 2008	BLT	RCT, 2x2 factorial design	49/46	BPSD; ADL, sleep, cognition, QoL, mood	CMAI; ADLs, MMSE.Pitt. Geriatric Center	NH
Rodiek, 2002	HT	Quasi-exp. pre post	6/10	Well-being; mood anxiety, cortisol	PANAS Pits Anxiety; State Trait Anx Inventory & Cortisol	comb. Apts & NH
Sakamoto et al, 2012	AT	RCT	73/72	BPSD; falls, QoL; cognition	CMAI Barthel index	NH
Satlin et al, 1992	BLT	pre post	10/NA	BPSD, sleep	Measured sundowning behaviors	Geropsych unit
Skjerve et al, 2004	BLT	pre post	10/NA	BPSD, Sleep	CMAI, BEHAVE-AD, actigraph	NH
Smallwood et al, 2001	AT	RCT	7/7	BPSD	Obs	Geropsych unit

Table 4.1. continued

1st Author	Type of NRE	Study design	n= T/C group	Outcome studies	Instruments used to measure outcome	Setting
Tse, 2010	HT	Quasi-exp. Pre-post	26/27	Well-being, life satisfaction & Phys Fxn	Life Sat Index UCLA Loneliness scale, Barthels	NH
Yasukawa, 2009	HT	pre post	21/NA	QoL	MMSE, Obs	NH

AT=aromatherapy; BLT=bright light therapy; HT=horticulture therapy; BPSD=behavioral and psychological symptoms of dementia; CMAI=Cohen-Mansfield Agitation Inventory; NA=not applicable; NPI=neuropsychiatric inventory; PANAS=positive and negative affect scale; QoL=quality of life; Obs=observation; RCT=randomized controlled trial; NH=nursing home; TDAS=Touch panel Dementia Assessment Scale

Table 4.2. ES statistics and heterogeneity for NRE and moderators

Variable	Design	k	ES	SE	LL	UL	p value	Q value	I^2	T^2
NRE	2	17	0.484	0.138	0.215	0.754	0.000*	52.120	73.139	0.194
	1	7	0.758	0.109	0.544	0.973	0.000*	4.653	0.000	0.000
Moderators: AT	2	6	0.727	0.221	0.294	1.159	0.001*	16.558	69.803	0.187
	1	0	NA	NA	NA	NA	NA	NA	NA	NA
BLT	2	7	0.228	0.176	-0.118	0.573	0.196	19.829	69.742	0.147
	1	4	1.059	0.248	0.573	1.545	0.000*	2.305	0.000	0.000
HT	2	2	0.746	0.537	-0.307	1.799	0.165	4.290	76.689	0.448
	1	3	0.686	0.122	0.446	0.925	0.000*	0.520	0.000	0.000
Dose Mod	2	11	0.475	0.145	0.191	0.759	0.001*	28.276	64.634	0.145
Dose low	2	6	0.562	0.238	0.099	1.029	0.018*	17.618	71.620	0.224
Outcome: QoL										
NRE	2	10	0.579	0.171	0.243	0.915	0.001*	40.397	77.721	0.219
	1	7	1.347	0.256	0.020	0.719	0.000*	28.481	78.933	0.355
AT	2	2	0.369	0.178	0.019	0.710	0.038*	0.204	0.000	0.000
	1	0	NA	NA	NA	NA	NA	NA	NA	NA
BLT	2	4	0.294	0.277	-0.248	0.837	0.288	16.291	81.585	0.247
	1	0	NA	NA	NA	NA	NA	NA	NA	NA
HT	2	4	1.027	0.291	0.456	1.599	0.000*	11.827	74.634	0.241
	1	7	1.347	0.256	0.846	1.849	0.000*	28.481	78.933	0.355
Dose Mod	2	6	0.846	0.237	0.382	1.310	0.000*	21.544	76.792	0.247
Dose low	2	3	0.904	0.312	0.293	1.515	0.004*	4.456	55.119	0.161

*Significant at the 0.05 level, CI at 95%.

AT=aromatherapy; BLT=bright light therapy; ES=effect size; HT=horticulture therapy; NRE=natural restorative environment; LL=lower level of Confidence interval; SE=standard error; UL=upper limit of confidence interval

Table 4.3. Summary statistics, 2 groups, for individual studies for BPSD & QoL

	N	SDM	SD	LL	UL	Z-Value	Type NRE	p-Value	Variance
Alessi	62/56	-0.122	0.185	-0.484	0.239	-0.663	BLT	0.508	0.034
Ancoli-Isreal	31/31	0.943	0.268	0.418	1.467	3.520	BLT	0.000	0.072
Ballard	36/36	1.093	0.253	0.598	1.588	4.326	AT	0.000	0.064
Brown	33/33	1.227	0.268	0.701	1.753	4.572	HT	0.000	0.072
Burns	22/26	-0.131	0.252	-0.626	0.363	-0.519	BLT	0.603	0.064
Burns 2009	38/39	-0.159	0.290	-0.727	0.410	-0.547	BLT	0.584	0.084
Connell	10/10	0.146	0.448	-0.732	1.023	0.325	HT	0.745	0.201
Fujii	14/14	0.667	0.388	-0.094	1.428	1.717	AT	0.086	0.151
Holmes	15/15	0.936	0.385	0.182	1.690	2.434	AT	0.015	0.148
Lin	35/35	0.870	0.250	0.380	1.360	3.479	AT	0.001	0.063
Lyketsos	15/15	-0.145	0.366	-0.862	0.571	-0.397	BLT	0.691	0.134
Mishima	14/10	0.577	0.289	0.012	1.143	2.000	BLT	0.045	0.083
Riemersma-van der Lek	49/46	0.581	0.211	0.168	0.994	2.757	BLT	0.006	0.044
Sakamoto	21/21	0.066	0.166	-0.260	0.391	0.395	AT	0.693	0.028
Smallwood	7/7	1.031	0.569	-0.084	2.146	1.812	AT	0.070	0.324
Random Effects Model	**402/394**	**0.484**	**0.138**	**0.215**	**0.754**	**3.519**		**0.000**	**0.019**
	N	**SDM**	**SD**	**LL**	**UL**	**Z-Value**	**Type NRE**	**p-Value**	**Variance**
Alessi	62/56	0.873	0.193	0.495	1.251	4.525	BLT	0.000	0.037
Ballard	36/36	0.441	0.239	-0.027	0.909	1.848	AT	0.065	0.057
Barnicle	31/31	0.661	0.261	0.150	1.173	2.535	HT	0.011	0.068
Burns	22/26	0.008	0.252	-0.486	0.502	0.033	BLT	0.974	0.064
Dowling	29/17	0.509	0.310	-0.098	1.117	1.643	BLT	0.100	0.096
Jarrott 2002	9-Sep	0.872	0.493	-0.095	1.838	1.767	HT	0.077	0.243
Jarrott 2010	75/54	0.717	0.184	0.356	1.078	3.898	HT	0.000	0.034

Table 4.3 continued

	N	SDM	SD	LL	UL	Z-Value	Type NRE	p-Value	Variance
Jimbo	28/28	0.279	0.269	-0.248	0.805	1.038	AT	0.299	0.072
Riemersma-van der Lek	49/46	-0.218	0.216	-0.642	0.206	-1.006	BLT	0.314	0.047
Tse	26/27	1.957	0.334	1.302	2.611	5.856	HT	0.000	0.112
Random Effects Model	**367/311**	**0.579**	**0.171**	**0.243**	**0.915**	**3.381**		**0.001**	**0.029**

NRE=natural restorative environment; LL=lower level of Confidence interval; p=value; Q=statistic; RW=relative weight; SE=standard error; V=variance; UL=upper limit of confidence interval

Table 4.4. Summary statistics, 1 group, for individual studies for BPSD & QoL

BPSD	N=	SDM	SE	LL	UL	Z-Value	Dose	Type NRE	p-Value
Detweiler	28	0.644	0.160	0.330	0.957	4.025	54	HT	0.000
Haffmans	10	0.719	0.355	0.024	1.415	2.027	18	BLT	0.043
Lee	23	0.834	0.242	0.360	1.309	3.447	13	HT	0.001
Lovell	6	1.033	0.615	-0.172	2.237	1.680	11	BLT	0.093
MCMinn	13	0.604	0.302	0.013	1.195	2.004	5	HT	0.045
Satlin	10	1.711	0.995	-0.239	3.660	1.720	9	BLT	0.085
Skjerve	10	1.512	0.463	0.605	2.419	3.266	11	BLT	0.001
Random Effects Model		**0.758**	**0.109**	**0.544**	**0.973**	**6.928**			**0.000**
QoL	N=	SDM	SE	LL	UL	Z-Value	Dose	Type NRE	p-Value
Collins	18	1.591	0.355	0.896	2.286	4.484	11	HT	0.000
Detweiler	28	0.548	0.385	-0.206	1.303	1.424	54	HT	0.154
Gigliotti 2004	14	1.451	0.383	0.701	2.202	3.790	15	HT	0.000
Gigliotti 2005	48	1.937	0.245	1.457	2.417	7.913	13	HT	0.000
Heliker	24	1.798	0.330	1.151	2.446	5.446	8	HT	0.000
Lee	23	1.654	0.321	1.025	2.283	5.155		HT	0.000
Yasukawa	21	0.455	0.229	0.006	0.905	1.986	13	HT	0.047
Random Effects Model		**1.347**	**0.256**	**0.846**	**1.849**	**5.263**			**0.000**

Table 4.5. Study characteristics

Sample size included in MA	33
Sample size included for dose/ characteristics*	43
Percent two group design	50%
RCTs	k= 13
pre post comparison group	k= 17
pre post control group	k= 5
BPSD as outcome	k=24
QoL as outcome	k=20
Both outcomes	k=5
Mean age	76.38 (k= 35)
Percent female	59.85 (k=38)
Settings- NH	25
-Geropsych unit	6
-ADS	4
Passive vs Active intervention	19/16
Individual vs. group activity	25 **/16
Controlled for medications	29
Percent randomized	14
Presence of agitated behaviors	17
Reported randomization	k= 16
-Reported blinding	k= 12
-Reported attrition	k= 6
-Reported inter-rater reliability	k= 21
-Reported on power calculations	k=4
Reported on analysis of homogeneity between groups	k= 16
Reported training of data collectors/ rates	k= 19
Reported on compliance to interventions	k=24
Reported on stabilization of medications	k=15

*not enough data presented to include in MA

**several studies included both individual and group activity involved.

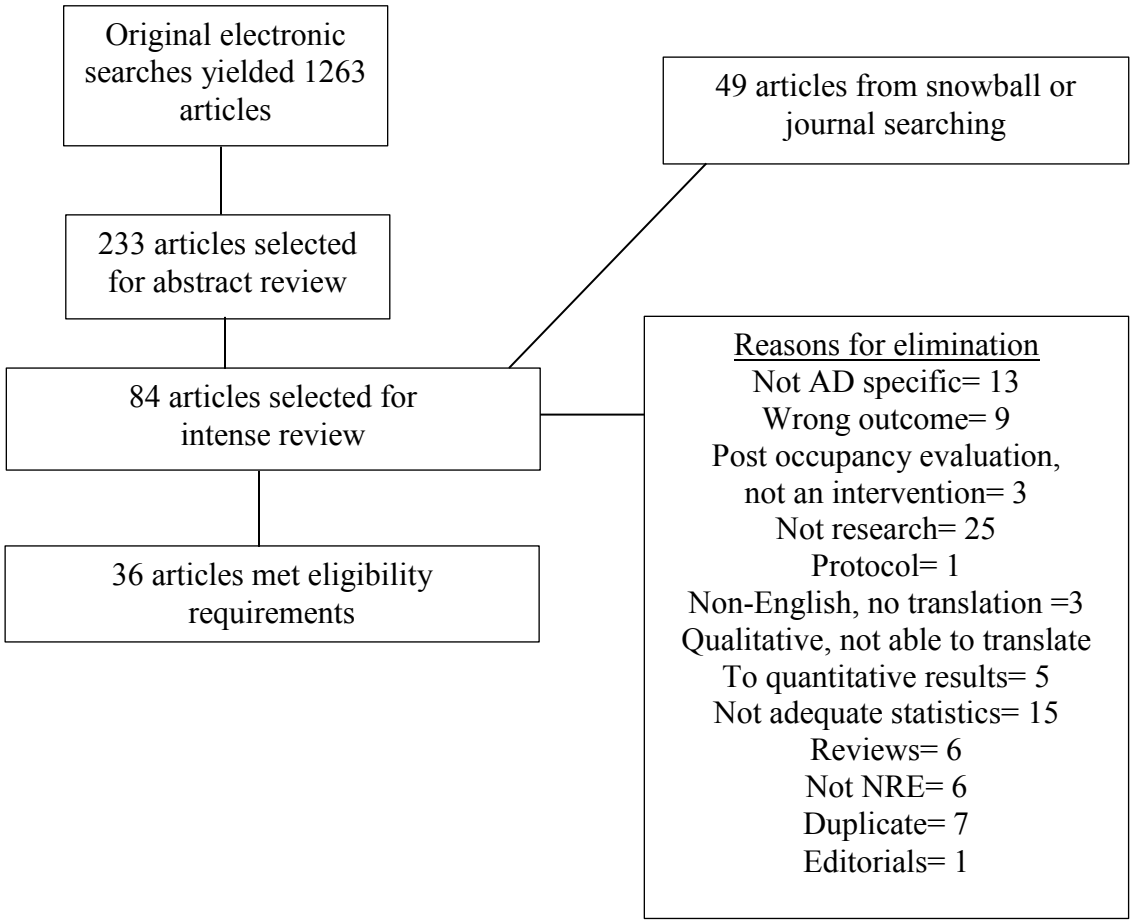

Figure 4.1 Flow chart of article research

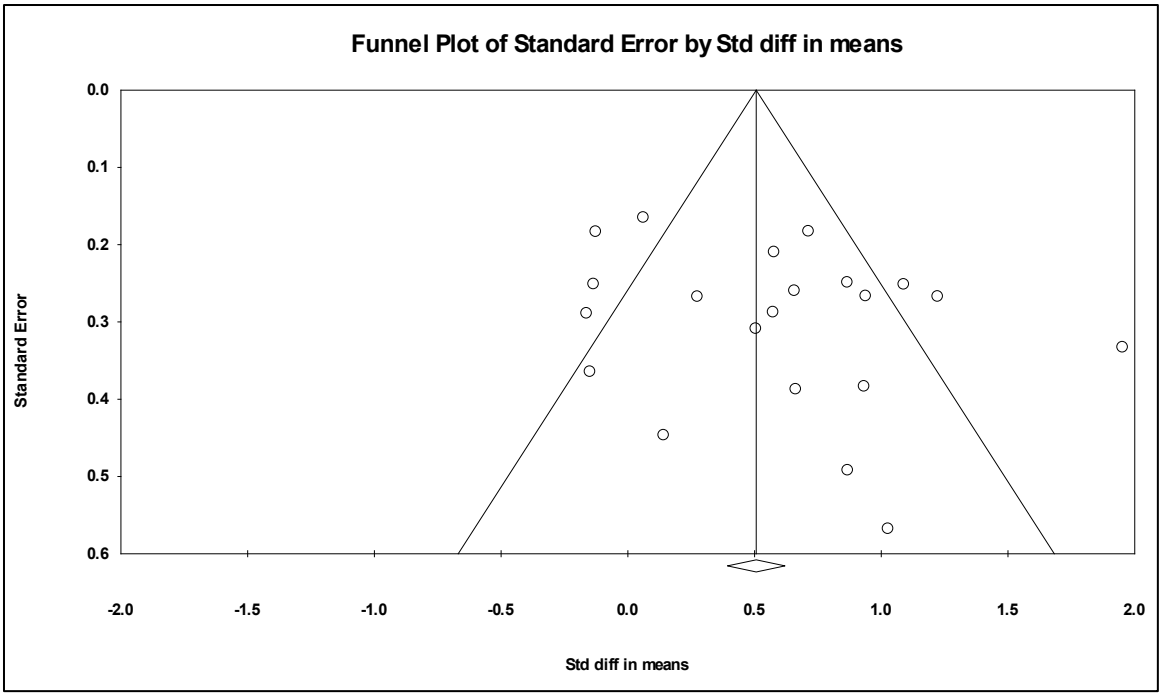

Figure 4.2. Funnel plot to show potential publication bias

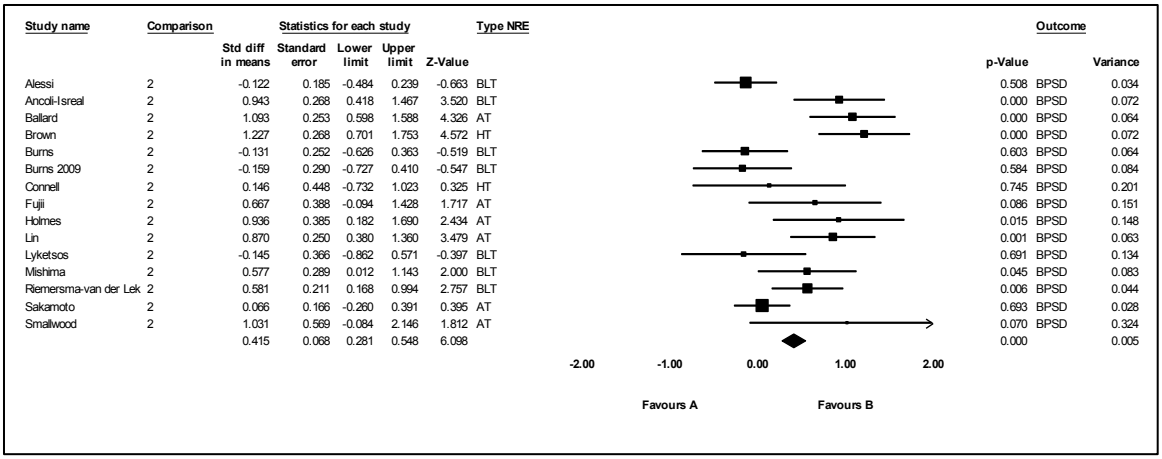

Figure 4.3. Forest plot for BPSD outcome

The size of the boxes indicates weighting of study. Diamond at the bottom is ES total.

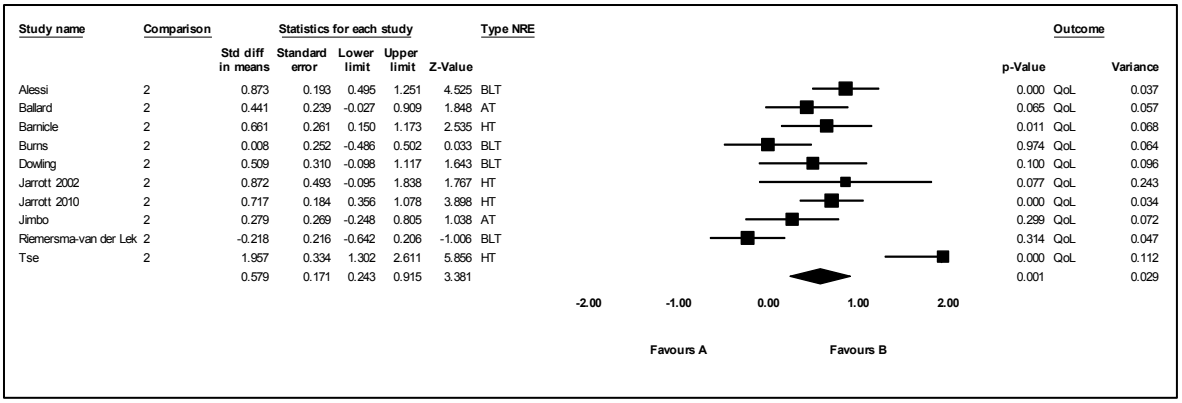

Figure 4.4. Forest plot for QoL outcome

The size of the boxes indicates weighting of study. Diamond at the bottom is ES total.

CHAPTER V

SYNTHESIS OF THESIS

Overview

One of the most distressing concerns to people as they age is the possibility of getting dementia. This fear is very real since many have had loved ones, or others we know, develop the cardinal symptoms of AD: loss of memory and cognitive capacity, and disturbing personality changes. The disturbing behaviors associated with dementia (termed BPSD) cause not only patient suffering but burden the family and caregivers, and usually eventually trigger premature institutionalization. Once institutionalized, AD patients often become a source of frustration for care staff, resulting in costly increases in staff time and care dollars. This distress compounds the negative consequences in quality of life AD patients and their families (Gaugler et al., 2000). As the Baby Boomer population ages, the number of AD cases will rise. This situation threatens to place monumental demands on America's health care system. Commentaries expound on the strain of increasing burdens of Medicare and Medicaid dollars for caring for the elderly population and the increased use of federal dollars this cohort requires at the end of their lives.

Negative publicity has only contributed to the stigma of an AD diagnosis and of caregiving for a person with AD; and misperceptions about the disease abound. The popular press often describes people with AD as "a shell of themselves" or "no longer the person they knew." Perhaps, then, it is no wonder that the media concentrates on drugs being developed to prevent and treat AD but rarely portrays positive images of a life with AD or caregiving for loved ones with AD.

Experts agree that, for people with AD, the issues of quality of life, health, normalizing life, and limiting behavioral reactions are best addressed by a combination of environment, pharmacology, and behavioral modalities (Logsdon, et al., 2007; Salzman, et al., 2008). Traditional treatments associated with behaviors associated with AD include medication management and non-pharmacological interventions, with medication being far overused but showing little benefit. In fact, a longitudinal regression analysis showed that AD subjects taking donepezil experienced a significantly lower quality of life (interaction: week 12 x donepezil; p= 0.02), and no significant differences for the neuropsychiatric inventory (NPI) or Barthel index (Burns et al., 2011). That study illustrated the misguided aspect of treating AD patients primarily with medication, as do "black box" warnings about the psychotropic medications used to treat BPSD symptoms. The failure of these drugs makes research and development for non-pharmacological interventions an urgent healthcare issue.

For AD patients, engagement, socialization, and individualized nonpharmacological interventions are important components of increasing pleasure (or quality of life) and decreasing agitation (Cohen-Mansfield, Libin, & Marx, 2007; Kolanowski, Buettner, Costa, & Litaker, 2001). These multi-faceted influences on QoL follow the same dimensions in AD patients as in all people and include a connection with the natural environment, which often plays an important role in most people's lives (Duggan et al., 2008; Cohen-Mansfield et al., 2012). Interacting with nature has long been recognized as positively affecting multiple dimensions of health, and as such is a vital part of our bio-psychological and spiritual well-being (Kaplan & Kaplan, 1989).

This dissertation presents a meta-analysis, conducted to determine a pooled effect size from studies on interventions seated in the naturally restorative environment (NRE); the analyzed outcomes were behaviors (BPSD) and QoL for persons with AD. A total of 34 studies were included in the MA, with three major moderators, aromatherapy (AT), bright light therapy (BLT), and horticulture therapy (HT). The outcome measures of interest chosen for this study included the concepts of agitation or behaviors (BPSD) and QoL. These outcome measures were chosen because they have a direct relationship to they are connected with the issues of persons with dementia living in long-term care.

The findings of the MA were mixed in that the BLT type did not appear to give significant benefit; nor did the two-group analysis for BPSD. Nevertheless, several analyses did support NRE interventions. As anticipated, every moderator, and design showed significant heterogeneity in every outcome. Since this was expected, the use of random effects model was employed for analysis. The heterogeneity was welcomed in that it provided a description of intervention characteristics and showed that, despite differences, the results remained significant for both outcomes. Heterogeneity did, however, lessen the precision of the findings.

Discussion

The importance of the environment has long been studied in relation to the care of persons with AD. In a study with psychogeriatric patients, confinement to indoors was found to be associated with increased physical and verbal agitation, and increased medication use (McMinn & Hinton, 2000). Humans' natural connection to nature makes interaction with the natural environment important to life; some psychologists would even classify it as a basic need (Kaplan & Kaplan, 1989). This is not changed by AD.

Nature has been demonstrated to be rich in restorative elements, provide multisensory stimulation, elicit a sense of peace and well-being, and have healing qualities (Herzog et al., 2002; Korpela & Hartig, 1996; Velarde, Fry, & Tveit, 2007). Yet, in later stages of AD and in nursing home (NH) environments, opportunities to interact with nature are often limited due to the diminishing capacity of the person with AD to think of, sequence, initiate the actions, and follow through with a plan, physically manage to access the space, and the need for support of others to navigate to the garden or activity.

A variety of disciplines have studied the use of nature-based interventions for nursing home residents with AD. Different disciplines such as architecture, landscape architecture, environmental design, gerontology, medicine, nursing, psychology, and psychiatry conduct research in this area. Environmental features have been studied from many perspectives (e.g. behavior, supportiveness, promoting independence, healing, nurturance, and ambiance); and elements of the natural environment have been included as part of some NH designs Much of the data from these studies suggests benefit, but the evidence has not been complied, synthesized or evaluated for the aggregate contribution. No standardization of methods to investigate, or outcome tools to use in persons with AD have surfaced, and little dialogue between the disciplines occurs. Furthermore, no systematic review, literature synthesis, or meta-analyses has addressed nature-based interventions in people with AD. Many relatively less rigorous, qualitative studies focused on multiple outcomes and study proxy measures of resident outcomes through staff attitudes, family report and surveys, not through the perspective of the person with AD. The use of wander gardens, horticulture therapy, and nature sounds during bathing are examples of nature-based interventions; however, they vary greatly in approach,

study design, specific intervention, outcomes evaluated, targeted population, sample size, and quality. Still a gap remains in studying the extent, effect, and use of the components of appropriate environmental design and interventions and how they affect persons with AD.

Qualitative studies provide a clear and more human picture of what it means to be confined indoors. One qualitative study described the feelings of depression felt by AD patients who are not able to go outdoors (Duggan et al., 2008). In this study, 20 people with early-stage AD were asked what they missed about going outside and a few main themes emerged: exercise, fresh air, emotional well-being, the opportunity for informal encounters with neighbors and friends and the appreciation of the natural landscape (Duggan et al., 2008). In other studies, persons with AD and their caregivers also reflected that features of the NRE encouraged more active participation in life, socializability, quality of life or meaningfulness, a sense of freedom, less agitation, and improved sleep patterns (Cioffi, Flemming, Wilkes, Sinfield, & Le Miere, 2007; Davis, Byers, Nay, & Koch, 2009; Kalis, Schermer, & van Delden, 2005).

Implications

The Centers for Medicare and Medicaid services (CMS) is charged with engaging in partnership to promote research and resources to facilitate the reduction of ineffective and over used psychotropic drugs (CMS, news release May 30, 2012). The emphasis on reducing psychotropic drug use in long term care encourages practitioners and providers to find other methods to diminish behavior issues, but meeting this goal will be complicated by the many different kinds of unmet needs and/or situations. To replace the overuse of sedative drugs that has become a problem in nursing homes, a variety of non-

pharmacological intervention methods must be developed. The most effective intervention is one based on the individual circumstances. If NRE interventions are part of that compendium of methods, and used by all providers consistently, we have an ability to impact the CMS goal, already off target, of decreasing use of psychotropic medications by 15% by 2012 (the goal set by CMS) (CMS, news release May 30, 2012). NRE has potential to be a source of nonpharmacological interventions in the toolbox for providers, especially as NREs have demonstrated a robust impact on BPSD and QoL. Practitioners need know about NREs and how to integrate the concepts into practice.

Limitations

As with any MA, this study cannot overcome the quality shortfalls of the individual studies it includes. Often, these studies report confounding results and major flaws in these studies including small sample sizes, not specifying the type of dementia used as inclusion criteria in the study, little control on dosage, duration and specifically undefined intervention, and varying outcome measures with scant report of measurement of effect sizes. To control for these shortcomings when compiling such data, study size and other statistical and inclusion/exclusion criteria can be weighted, as was done in this MA.

Another potential limitation is publication bias may be present as there were no studies found from grey literature. Nevertheless, strategies were employed to locate them, though none were found. In addition, statistical tests, the funnel plot and the Fail Safe N, were done in attempt to determine if this was the case. No statistical support was found to indicate there was publication bias.

The study of NRE comes from many disciplines, like architecture and landscape architecture, which complicated the search. This proved to be a limitation as many of the disciplines that are involved are not included in health related data-bases. Accordingly, databases outside healthcare databases were searched and a librarian consulted colleagues from other sciences. Nevertheless, sources may have been missed. When encountered, studies from other disciplines often used different research methods and instruments, some did not even report on outcomes. In addition, although the vast majority of searching was done systematically, pertinent articles were occasionally found while doing other research.

Finally, the generalizability of our findings is limited, as the majority of participants were in the middle to late stages of AD and restricted mainly to the nursing homes setting. This limitation was true of types of dementia as well. One study found differential results for vascular dementia and Alzheimer's type dementia. Although some studies classified results by type of dementia, these studies were not done rigorously. In addition, specificity was generally limited because specific behaviors were not identified.

Recommendations for Research

In addition to generating the estimated pooled effect size, this MA conducted regression analysis of moderators, identified theoretical models of interventions, and developed descriptions of NRE characteristics currently used. So despite the study's limitations, this MA generates knowledge that will be critical in outlining gaps and illustrating courses of needed research. For example, none of the studies applied NRE interventions to calm negative behaviors until after the disease had reached a late stage, so none tested whether NRE might forestall institutionalization. Indeed, the compiled

studies were mainly done in populations with late-stage AD and in long-term care. In contrast, it is probably important, to design NRE interventions for patients in earlier stages of AD; indeed, the theoretical model favored argues that restoring a person's capacity for attention facilitates cognition, and boosts executive functions (e.g., problem solving), qualities that should help keep those with dementia out of nursing homes for longer.

While the evidence supports that NRE improves quality of life, and provides activities that benefit the person with AD; in the literature reviewed, no study was found that delved into caregiver outcomes. It is acknowledged that many interventions directed at caregiver training are effective in relieving stress and burden of caregivers themselves; and this may be a ripe area for innovation (Hepburn, Lewis, Sherman, & Tornatore, 2003; Kovach et al., 2004; Teri, McCurry, Logsdon, & Gibbons, 2005). One pertinent study presented evidence that balancing arousal states (or BACE) may decrease agitation (Kovach et al., 2004); and a less agitated patient will undoubtedly relieve caregiver burden. A natural environment may provide the needed lowered arousal necessary for restoration and thus decreasing unwanted behaviors.

To be successful, an intervention must work in real life situations not just in highly controlled clinical trials (Lagomasino et al., 1999). Certainly, prescribing and dosing drugs requires relatively little effort, but pharmacological interventions show limited efficacy and often have side effects. To meet the needs of their AD patients, providers need to be empowered with choices of potentially effective interventions. They need a range of interventions that can be implemented at any given time, based on the underlying cause and situation. There exists a gap in knowledge about how specific

behaviors respond to different interventions, so more targeted, rigorous studies need to be done so we can realize the potential of NRE interventions.

An interesting outcome that this MA could not examine was how the NRE affects cognition and functional activities in persons with AD; this could not be evaluated because outcomes have not been studied in detail. Nevertheless, the few studies encountered during this MA indicated positive findings (Jimbo et al., 2009; Lee & Kim, 2008). In support of this idea, substantial evidence shows that environmental enrichment, also termed cognitive enhancement, contributes to central nervous system function (cognition) by promoting neural plasticity (Hertzog et al., 2008). Future NRE studies must evaluate outcomes related to cognitive functioning, especially in early stages and mild cognitive impairment (MCI) when functional and cognitive abilities are less compromised. Maintaining function and improving cognition would have a great impact on the potential to maintain functional abilities, QoL, as well as keeping persons at home longer in a safe environment. These important outcomes need to be incorporated into future research.

Other specific areas for research include establishing the connection of circadian rhythm normalization and BLT. Researchers suggest the involvement of hormones in the resetting of circadian rhythm normalization may require a longer duration than previous studies indicated (Riersma-van der Lek et al., 2008). Indeed, to be effective, the body must synchronize with BLT, a process known to happen slowly. Thus, hypothetically, some of the low and insignificant ES findings in BLT studies may be due, in part, to a too-short experimental time window. The Riersma-van der Lek et al. (2008) study also showed that BLT plus melatonin had an additive effect. Considering this component in a

longitudinal BLT study, and tracking subjects with biological markers, would add to the specification of BLT efficacy. Finally, an interesting study found BLT calmed agitation more effectively in patients who were less agitated at the outset (Lovell et al., 1995), providing a key consideration for anyone developing new BLT studies and determining the characteristics of people who might respond better than others.

Recommendations for Education

Nursing education could be enhanced by teaching findings from NRE studies. Whether students are at beginning or graduate levels they should be taught that exposure to the natural environment is a basic need, that nature holds restorative properties, and the benefits it can have on patients, caregivers, and families in different situations. Research and study of NRE interventions can be an important area for graduate projects or PhD, DNP, or master's theses research.

For faculty, we stress the importance of teaching students to incorporate NRE interventions in working with patients on clinical experiences. Students should be aware of important, relevant findings, such as early studies on the attention restoration theory showing that attention scores on neuro-psychiatric tests improved after subjects took a walk in the woods versus an urban environment (Felsten, 2009; Korpela & Hartig, 1996). These ideas might have the added benefit of reducing the stress of nursing studies themselves. As professors we would be doing a service to our nursing students to recommend a respite in nature prior to exams. On a professional level, since many healthcare facilities are equipped with outdoor environments, faculty could encourage students to utilize these areas for patients going in for tests or procedures. Whether in

pediatrics, community, public health, in-patient, or long-term care, students might utilize the findings from this MA to encourage the QoL and well-being of their patients.

Recommendations for Practice

As mentioned, many hospitals across the nation are developing garden units and respite areas that include natural features, so families, patients, and staff have a place to try to relax during stress-filled times (Providence Benedictine Nursing Center, Portland, OR; The Pebble Project, San Francisco, CA). This real-world evidence shows NRE interventions apply to many populations, not only the elderly and people with AD. Benefits are seen in multigenerational populations, in many different settings, for many different diseases and conditions.

Implications for practice are directed not only at patients but also at staff. Studies demonstrate that the NRE benefits staff as well as patients: staff make fewer mistakes and show less burn out when they have pleasant outdoor nature to enjoy, as opposed to, for example, a staff room with no windows (Berman et al., 2008; Berto, 2005; Kaplan, 2001). Research supports the idea that a worker's directed attention (sometimes referred to as executive attention) is a key component of performance and needs to be replenished (Berman et al., 2008). Exposure to nature scenes was shown to enhance directed-attention abilities, and also increased job satisfaction and decreased turn over (Berman et al., 2008). This might be especially important as long shift configurations are increasingly used in health care with safety identified as a major problem.

Administration also needs to be educated about the importance of encouraging or providing staff education about the value of NRE for residents, families, and staff. Use of garden spaces and the incorporation of NRE in everyday work must be encouraged. In

fact, rather than encourage, perhaps there is a need to prescribe their use on individual care plans and begin to view this as an intervention, rather than "a nice thing to do if there is time."

Interdisciplinary work in healthcare settings and educational/research settings could also benefit from learning more about NRE and the impact interactions with nature can have. More providers should realize their role in promoting patient outcomes (like QoL). Staff in facilities that provide care for persons with AD (for example CNAs in long-term care) need to incorporate NRE in daily activities, and nurses and therapists to include NREs in their care plans. These efforts need to be endorsed through effective leadership and administrative methods.

We can look outside the area of AD and dementia to find the benefits of NRE interventions. For example, studies based in attention restoration theory (ART) were done in populations of women with breast cancer and multiple sclerosis (MS) (Cimprich & Ronis, 2003; Tenessen & Cimprich, 1995). These populations were newly diagnosed with conditions that carry with them a great deal of stress and mental fatigue, as well as complex and challenging treatments. Women were asked to engage in some form of interaction with nature—viewing nature on a car ride, taking a walk, or sitting in a garden—and then journaling about it, for 120 minutes per week. The women in the experimental condition, as compared with the control group, showed greater capacity to direct attention from the pre-surgery to post-treatment period. The studies were consistent in their findings across populations, breast cancer or MS. The NRE intervention supported reflection for thoughts, feelings, and interactions, time to make sense of events, and the ability to confront nagging or painful issues. The benefits noted a rested

attentional capacity and improved mental clarity, which are especially important when an individual is dealing with the mental demands of newly diagnosed condition. These findings have significant implications for nursing practice. If, by encouraging our patients to take time during their day to "restore" their attention, we have a potential to empower our patients (and ourselves) to improve mental capacity. This may have particular relevance to persons newly diagnosed with Alzheimer's or other dementing illnesses. It also has relevance to their caregivers, since dementia patients are known to be extremely stress inducing and difficult, and yet caregivers get little assistance with how to cope (Specht, Taylor, & Bossen, 2009).

Policy Implications

In 2012, President Obama endorsed a groundbreaking agenda for Alzheimer's disease for the nation, the National Alzheimer's Plan (NAPA). This plan outlines five goals: 1) prevent and effectively treat AD by 2025; 2) optimize care quality and efficiency; 3) expand supports for people with AD and their families; 4) enhance public awareness and engagement; and 5) track progress and drive improvement (Khachaturian, Khachaturian, & Thies, 2012). In addition, the subcommittee on research recommended several important components, most importantly for NRE research, to "accelerate basic and translational research toward development of effective treatments", (2012).

These governmental mandates ground the importance of research initiatives based in affordable, effective, patient oriented, nonpharmacological treatments for disease management and treatment, such as nature based interventions. NRE intervention benefits are not limited to the "patient" but have implications for caregivers, both formal and informal. The new NAPA policy supports research that targets AD caregivers; these

programs could develop interventions that included the importance of nature-based activities to help relieve stress, and potentially delay disease impairments while delaying institutionalization. The NAPA initiatives budget 156 million for AD research and caregiver support within the next two years (2013-2015), 50 million to NIH to support research efforts, and 6 million for caregiver support, education, and public awareness (Khachaturian et al., 2012). The 2013 Obama budget also includes 146 million, a two million dollar increase, to National Institutes of Nursing Research (NINR) (AACN Policy Beat, April, 2013).

In the Institute of Medicine's report on, *The Future of Nursing: Leading Change, Advancing Health* (2011), one of the recommendations for enhancing health care is Recommendation 2: Expand opportunities for nurses to lead and diffuse collaborative improvement efforts. This provides important strategic motivation for NRE interventions for two reasons: 1) in education, we need to prepare future nurses to care for the expanding aging population and all of the associated complexities; and 2) as nurse leaders we need to be able to lead change and manage collaborative efforts in producing more effective health care environments. The IOM report goes on to state that, "private and public funders, health care organizations, nursing education programs, and nursing associations should expand opportunities for nurses to lead and manage collaborative efforts with physicians and other members of the health care team to conduct research and to redesign and improve practice environments and health systems. Nurse leaders and clinical practitioners need the knowledge to advocate for and facilitate opportunities to diffuse successful practices" (p. 12, IOM report, 2011). NRE interventions provide

excellent opportunities to enhance the nursing workforce and the lives of their patients with AD.

A recently published report of a cross sectional study of 134 hospitals indicated that the increased percentage of bachelor prepared nurses (BSNs) in hospitals was able to decrease surgical mortality and failure-to-rescue efforts; and BSNs held even greater potential to impact chronic healthcare conditions (Kutney-Lee, Sloane, & Aiken, 2013). This was supported by similar findings from another study of 21 hospitals (Blegen, Vaughn, Goode, Spetz, & Park, 2013). NRE interventions research could find financial support in the Patient Centered Outcomes Research (PCORI) funding for "real world" settings–part of the National Alzheimer's Plan, but foundationally supported by the IOM report. These government initiatives provide the promise of funding collaborations between nursing research initiatives and care facilities, especially long-term care, to focus on improving patient centered outcomes which might incorporate NRE intervention outcome studies, as well as translational research studies.

Conclusion

In summary, the findings form this MA support the use of NRE interventions to improve quality of life and well-being and diminishing disturbing behavior responses in persons with AD in long term care settings. Additionally, these findings have important implications for research, education, practice, and policy initiatives. Further research on specific moderators needs to continue and educational initiatives need to begin to bring awareness of care-providers, both professional and nonprofessional, about the importance of or need for interaction with the natural environment.

APPENDIX A

THE IMPORTANCE OF GETTING BACK TO NATURE FOR PERSONS WITH DEMENTIA

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Abstract

As people age, the ability to interact with the outdoors may lessen. Frailty and mobility problems create barriers to engaging in outdoor activities or even experiencing the outdoors. The barriers are greater for people with dementia. As the disease worsens to the point of institutionalization, access to the outdoors may be completely barred and opportunities relinquished to the determination of facility personnel. This article will review current literature and some older seminal works on nature and nature-based stimuli for people with dementia, especially those living in nursing homes.

Alzheimer's disease (AD) and related dementias is one of the greatest impending health issues the world will face with the aging of the Baby Boomer generation. AD affects areas of cognitive capacity, which may include memory, attention, language, personality, and problem solving, and eventually progresses to neuromuscular involvement, disability, dependence, and death (Aalten, de Vugt, Jaspers, Jolles, & Verhey, 2005; Morris, 2006). Dementia is associated with behaviors that can be disturbing and disruptive and often results in a mismatch between environment and needs or excessive stressors (Algase et al., 1996: Hall & Buckwalter, 1987). Nursing home placement is often due to difficult and disruptive behaviors, which occur in nearly every person with the disease at some point during the course of the illness (Lyketsos et al., 2002). Behavior

symptoms associated with dementia account for many negative health outcomes, such as declines in functional status, social engagement, and physical activity (Lyketsos, 2007), and increase the cost of care (Murman & Colenda, 2005). Behavioral consequences have also been shown to negatively affect quality of life and increase caregiver burden (O'Brien, Shomphe, & Caro, 2000).

Management of behavior symptoms associated with dementia is a complex process, and many approaches have been used to intervene on the behavior (Logsdon, McCurry, & Teri, 2007). These behavior symptoms may be exacerbated or triggered by environmental and/or interpersonal interactions (Logsdon et al., 2005). The precipitating factors of the behavior are many and are often specific to individuals. Getting to know and understand the person are key to discovering some of the underlying variables that precipitate the behaviors so the potential for them to occur can be eliminated or minimized.

Some strategies focus on prevention while others focus on the environment or management by medications. Historically, the focus of interventions has not been on psychological or emotional well-being (Reimer, Slaughter, Donaldson, Currie, & Eliasziw, 2004), and it is now generally agreed that preserving the opportunity for meaningful, constructive interactions between resident and caregiver is paramount. Provision of environmental support to maintain function as long as possible is increasingly being recognized as a way to address the psychosocial needs of individuals with dementia. Therefore, it is important for both formal care providers (e.g., nurses, nursing assistants) and informal caregivers (e.g., family, friends, community service providers) to address the physical and mental health of people with dementia. This

includes understanding the environmental preferences, experiences, and activities to which the person with dementia responds, promoting these aspects of health, helping the person achieve a sense of mastery, and ultimately enhancing quality of life.

Nature and Health

Nature can have a profound effect on people's health, well-being, and quality of life. As AD progresses, the symptoms worsen, and the result is often severely diminished capacity to communicate one's needs and desires, as well as determine where one goes and when. The result is often institutionalization where self-determination is restricted further (Aalten, van Valen, Clare, Kenny, & Verhey, 2005). Studies have demonstrated some effectiveness of multimodal sensory stimulation (of which nature has an abundance) approaches to interventions. Although people with dementia react differently to stimuli, intervention study findings include reductions in agitation, improved depression, greater diversity of activity, improvement in mood, positive staff interaction, and enhanced well-being (Brooker & Woolley, 2007; Detweiler, Murphy, Myers, & Kim, 2008; Logsdon et al., 2007; Milev et al., 2008). It is a natural progression to look more specifically at interventions and environments that include opportunities to interact with nature as a way to promote the physical and mental health, well-being, and quality of life of people with dementia.

For the purpose of this article, the definition of nature exposure or experience includes a passive interaction, such as watching birds through the window, listening to bird calls, or sitting on a bench outdoors looking at flowers, as well as a more active and interactive approach that could involve gardening, walking along a path, doing chair exercises in a sunroom, or animal-assisted therapy. However the interaction or exposure

occurs, it can provide an abundant source of multisensory stimulation in physical, emotional, behavioral, psychological, spiritual, and/or cognitive domains.

Although the use of nature may differ in individual studies, as a whole, nature exposure may represent any or multiple forms. Overall environmental design that includes nature experience opportunities has been demonstrated to be important in dementia care and quality of life, so at times, the integration of natural environmental components may be the variable studied (Zeisel et al., 2003).

Underlying Theory

Studies have demonstrated the environment is an important contributor to the quality of life and well-being of people with dementia (Kolanowski & Whall, 2000). Environmental factors include the physical, social, psychological, and emotional environment, as well as the experience of nature. In a study of people with dementia, the experience of being in nature was shown to be important for many reasons, including well-being and a sense of normalcy (Duggan, Blackman, Martyr, & Van Schaik, 2008). Nature is an important part of our physical world, and although we react to nature in different ways, human beings have a connection to all natural things (Wilson, 1984). Many components in the natural environment are described as having restorative and healing powers (Kaplan, 1995/2001). These factors, along with a world that can become increasingly restricted for people with dementia, make it incumbent on nurses, as care providers, to understand the importance and meaning of being in nature for people with dementia.

Harvard biologist Edward O. Wilson (1984) coined the term *biophilia,* which describes an innate interconnectedness human beings have with nature. It is an essential

or basic experience that connects us to all other organisms at a primal level, and we are all interdependent. This creates a mind-body connection that reacts fully to nature. When human beings are exposed to natural objects or views, a response is elicited in a physiological, psychological, and/or emotional process. The response to a nonthreatening natural environment stimulus has a positive effect on people's emotional state, followed by an autonomic arousal that is seen through positive changes in physiological activity levels, increases in sustained attention, and decreases in negative emotions (Berto, 2007; Kaplan, 2001; Rappe & Topo, 2007; Ulrich, 1984). This was first demonstrated by Ulrich (1984) in his seminal study that supported improved healing times of surgical patients with view of trees from a window in an urban hospital.

The Healing Power of Nature: Review of Literature

Studies provide examples of the effective use of nature-based interventions with people with dementia. Nature's healing powers have been described in many examples and include interactions among behavior and outcomes and human phenomena. For instance, it may be difficult to differentiate whether positive outcomes are a result of increased exposure to natural light or fresh air, increased socialization, or greater autonomy. Nature-based interventions may target specific behaviors, actions, or systems; yet, this level of specification is relatively new and requires additional research. Although there are many kinds of behavior symptoms associated with dementia, not all specific behaviors have been studied in relation to nature interventions. Behaviors are usually categorized into the more generalized term *agitation.* For example, there has been some research on wandering but little on repeated vocalizations (von Gunten, Alnawaqil, Abderhalden, Needham, & Schupbach, 2008).

The healing properties of nature are not a new concept. During the Crimean War, Florence Nightingale recognized the decreased mortality rates of soldiers infirmed in tents compared with those housed in conventional hospitals (germ theory); in addition, her perspectives on sunshine and fresh air as critical to improved recovery have been noted (Nightingale, 1971). There is also a growing body of knowledge on the healing power of nature (Berto, 2007; Chapman, Hazen, Noell-Waggoner, 2007; Detweiler, Murphy, Kim, Myers, & Ashiai, 2009; Detweiler et al., 2008; Gerlach-Spriggs, Kaufman, & Warner, 1998; Kaplan, 2001; Rappe & Topo, 2007).

Attention, a cognitive skill that is increasingly impaired by AD, is essential for problem solving, appropriate behavior, and coping with situations. Restorative environments lead to stress recovery and improved affective states (Kaplan, 1995; Ulrich, 1984). Kaplan (1995) described a model of restorative environments and proposed the concept of attention restoration therapy. The properties of a restorative setting include: a) Being away physically or conceptually; b) Fascination: items or activities in the environment that effortlessly hold attention; c) Extent: the idea that one is extended in time and space to expand the mind; and d) Compatibility: the fit between a person's purpose and preferences.

Natural settings are rich sources of the components Kaplan (1995) outlined regarding restorative environments. In addition, prolonged mental effort (voluntary or directed attention) leads to fatigue; the result is lowered ability to concentrate and suppress distraction, heightened irritability, and a greater likelihood of accidents and errors in functioning (Herzog, Chen, & Primeau, 2002; Moore, 2007). This supports the idea of fatigue being a stressor that leads to behaviors associated with dementia.

Providing opportunities for attention restoration therapy has the potential for restoring attention and mental capacity, lessening the chance of disruptive behaviors.

Agitation often occurs simultaneously with sleep disturbances and appears to have a strong circadian component in many people with dementia (Martin et al., 2006). This idea is supported in the results of Lee and Kim (2008), who conducted a pilot study that used indoor gardening. They looked at sleep, agitation, and cognition after a prolonged period of activity. Scores on cognition and agitation significantly improved, as did wake after sleep onset, nap time, nocturnal sleep time, and sleep efficiency; however, total sleep duration did not significantly improve. In a study that included unspecified outdoor activities, Connell, Sanford, and Lewis (2007) also evaluated sleep and agitation. Their findings differed in that their intervention group showed a significant increase in maximum sleep duration, a decrease in verbal agitation, and trends toward a decrease in physical agitation; both the control and intervention groups had improved total sleep duration. A decrease in agitation scores after increased use of outdoor spaces was found in several other studies (Cohen-Mansfield, 2007; Connell et al., 2007; Detweiler et al., 2008; Namazi & Johnson, 1992; Whall et al., 1997).

Research findings on wandering have varied, but this may be due to disagreement about what constitutes wandering. There are several theories on wandering and how to affect it (Yao & Algase, 2006). Studies on gardens for wandering often have not specified the specific behavior of wandering, instead using the general term *agitation.* One study evaluated the effect of a supervised walking program; however, although it did include an opportunity to walk outdoors, the walking partners were not directed to walk outside, and

analysis did not control for that variable. The study did not find a significant impact on wandering (Thomas, Glogoski, & Johnson, 2007).

A search of qualitative research revealed several studies with people with dementia that included differing aspects of nature and outcomes. Rappe and Topo (2007) reported on two studies: One focused on the effect of greenery with results assessed by staff report, and the other included observations of residents who were either passively or actively interacting with nature. In measures of well-being and enhanced competence, they found positive correlations with those in both adult day settings and nursing homes. In addition, they noted decreased aggression, improved socializations, and increased social competencies from the familiar cueing in the natural environment that leads to reminiscence (Rappe & Topo, 2007).

A study by Detweiler et al. (2008) supported the quality of life and mood findings of Rappe and Topo (2007) but also looked at the influence of a wander garden on inappropriate behaviors in a dementia unit. They demonstrated that the more exposure to the garden, the fewer agitated behaviors; they also found that physical incidents increased while verbal inappropriateness did not change.

In a grounded theory study, Duggan et al. (2008) interviewed 22 people with dementia and 14 caregivers about how the disease had changed experiences for the person. The identified reasons the people with dementia valued the outdoor environment included exercise, fresh air, emotional well-being, the opportunity for informal encounters with neighbors and friends, and appreciation of the countryside. They also reported a loss of confidence and anxiety due to lack of familiarity in the environment. Three main themes were identified: the significance of the outdoor world to the people

with dementia, the impact of dementia on outdoor life, and the importance of familiarity of outdoor environment (Duggan et al., 2008).

Environmental Importance in Nursing Homes

The design of environments in long-term care has focused on addressing individual needs, personalizing care plans (or more recently, person-directed care), making the environment homelike, educating staff and caregivers to understand the disease process, and facilitating appropriate interactions (Barba, Tesh, & Courts, 2002; Day, Carreon, & Stump, 2000). Concepts such as the Eden Alternative® (Thomas, 1994) incorporate plants and animals into the daily life of the nursing home environment. In a study that examined environmental factors and how they related to behavioral health outcomes for people with dementia, Zeisel et al. (2003) found significant correlations between specific behaviors and environmental characteristics. For example, reduced aggression, agitated behavior, and psychological problems were associated with the environmental attributes of increased privacy and personal settings in bedrooms, an ambient environment, and residential character that facilitate resident understanding.

The environment has been recognized as a therapeutic entity that can promote functionality and well-being if designed correctly. Zeisel (2005) and Zeisel et al. (2003) identified appropriate features for dementia units, including walking paths and accessibility to outdoor freedom (e.g., a dedicated space for use by people with dementia, unlocked garden doors), that have the appropriate environmental support to ensure safety but decrease confusion with visible landmarks. They found a distinct association between measures of health and environmental design (Zeisel et al., 1994, 2003).

The number of garden areas or patios in nursing facilities is increasing. However, while these additions may provide an opportunity for experiences with nature, it is apparent they are not considered an integral part of life for people with dementia. Several studies have investigated barriers to use of outdoor spaces. Barriers include difficulty with access (e.g., locked or heavy doors, distant location), lack of handicapped-accessible designs (e.g., no handrails, poor surface materials), lack of safety features, lack of resting spaces once outdoors, untrained staff, lack of cueing features or landmarks, limited or small windows, lack of weather protection (e.g., canopies, screened or glassed-in enclosures), weather-related problems (e.g., excessive heat, cold, sun, rain), and lack of easy access to bathroom facilities and drinking fountains (Cohen-Mansfield, 2007; Detweiler et al., 2008; Gibson, Chalfont, Clarke, Torrington, & Sixsmith, 2007; Grant & Wineman, 2007; Rappe & Topo, 2007).

Staff knowledge and concerns for safety are a crucial part of access to and use of outdoor areas for people with dementia. This is an important area for education, as an increased incidence of falls is not supported in the literature (Detweiler et al., 2009). In their study of people with dementia using wander gardens, Detweiler et al. (2008/2009) demonstrated a reduction in falls in a group of high-garden-use residents compared with a low-garden-use group in the year following the garden opening. They also found decreased use of high-dosage antipsychotic medications.

There are some general limitations in the many of the available studies, such as small samples, lack of a control group, and poor control on definition and dosage of interventions. Research has been limited to case studies, exploratory and observational studies with convenience samples, and a limited number of randomized controlled trials.

Many studies use qualitative methodology, and some would consider this a limitation. However, if it considers the perspectives of people with dementia, such research is an important source of information that can lead to improved person-directed care.

Summary

Nurses and other caregivers in the multiple care environments that provide services for people with dementia need to expand their understanding of the importance and meaning of experiences of the natural environment for the people with dementia. By making available a window with a view, a breath of fresh air natural multisensory stimulation we can provide a chance to restore and renew, as well as an opportunity for people with dementia to enhance their sense of mastery, their dignity, and their quality of life.

Nurses need to become aware of the importance of nature experiences for people with dementia and the role these experiences play in these individuals' well-being and quality of life. Understanding of the experience of being in nature for people with dementia may lead to insights into individuals' preferences and care needs and could provide valuable assistance for both formal and informal care providers in helping people with dementia optimize the experiences the individuals deem important.

APPENDIX B

CHARACTERISTICS AND POSSIBLE NEURAL SUBSTRATES OF SUBTYPES OF ATTENTION

Attentional subtype	Defining characteristic	Possible neural substrates
Selective attention	Focusing on single relevant stimulus or process at one time while ignoring irrelevant or distracting stimuli	Posterior parietal systems for orienting and shifting modulated by anterior middling and basal ganglia system for response selection
Sustained attention	Maintenance of abilities to focus attention over extended periods of time	Right sided frontoparietal system
Divided attention	Sharing of attention by focusing on more than on	Dorsolateral prefrontal cortex and anterior cingulated gyrus

From: Perry, J.R., & Hodges, J.R. (1999). Attention and executive deficits in Alzheimer's disease: A critical review. Brain, 122, 383-404. p. 385

REFERENCES

AACN Policy Beat. April, 2003. Accessed 6.22.2013 at; http://www.aacn.nche.edu/government-affairs/Apr13.pdf

Aalten, P., de Vugt, M., Jaspers, N., Jolles, J., & Verhey, F. (2005). The course of neuropsychiatric symptoms in dementia. part I: Findings from the two-year longitudinal Maasbed study. *International Journal of Geriatric Psychiatry, 20*(6), 523-530.

Aalten, P., van Valen, E., Clare, L., Kenny, G., & Verhey, F. (2005). Awareness in dementia: A review of clinical correlates. *Aging & Mental Health, 9,* 414-422.

Aguinis, H., Pierce, C.A., Bosco, F.A., Dalton, D.R., & Dalton, C.M. (2011). Debunking myths and urban legends about meta-analysis. *Organizational Research Methods. 14*(2), 306-331.

Alessi, C.A., Martin, J.L., Webber, A.P., Kim, E.C., Harker, J.O., & Josephson, K.R. (2005). Randomized, Controlled Trial of a Nonpharmacological Intervention to Improve Abnormal Sleep/Wake Patterns in Nursing Home Residents. *J Am Geriatr Soc 53*,803–810.

Alexander, G. E., Furey, M. L., Grady, C. L., Pietrini, P., Brady, D. R., Mentis, M. J., & Schapiro, M. B. (1997). Association of premorbid intellectual function with cerebral metabolism in Alzheimer's disease: implications for the cognitive reserve hypothesis. *American Journal of Psychiatry*, *154*(2), 165-172.

Algase, D. L., Beck, C., Kolanowski, A., Whall, A., Berent, S., Richards, K., & Beattie, E. (1996). Need-driven dementia-compromised behavior: An alternative view of disruptive behavior. *American Journal of Alzheimer's Disease, 11*(6), 10.

Akhondzadeh, S., Noroozian, M., Mohammadi, M., Ohadinia, S., Jamshidi, AH, & Khani, M. (2003a). Salvia officianlis extract in the treatment of patients with mild to moderate AD: A double blind randomized and placebo controlled trial. *Journal of Clinical Pharmacy and Therapeutics. 28,* 53-59.

Akhondzadeh, S., Noroozian, M., Mohammadi, M., Ohadinia, S., Jamshidi, AH, & Khani, M. (2003b). Melissa officianlis extract in the treatment of patients with mild to moderate AD: A double-blind, randomized, placebo controlled trial. *J Neurol Neurosurg Psychiatry. 74*, 863-866.

American Horticultural Therapy Association (AHTA). Forging new frontiers, Annual conference, Olympia, WA, October, 2012. www.ahta.org 10.29.2012

American Horticultural Therapy Association (AHTA) Position paper. www.ahta.org 10.29.2012

Ancoli-Israel, S., Martin, J., Gehrman, P., Shochat, T., Corey-Bloom, J., Marler, M., Nolan, S., & Levi, L. (2003). Effect of light on agitation in institutionalized patients with severe Alzheimer Disease. *American Journal of Geriatric Psychiatry*;11(2):194–203.

Annerstedt, M. & Wahrborg, P. (2011). Nature-assisted therapy: Systematic review of controlled and observational studies. *Scandinavian Journal of Public Health. 39*, 371-388.

Ayalon, L., Gum, A.M., Feliciano, L., & Arean, P.A. (2006). Effectiveness of nonpharmacological interventions for the management of neuropsychiatric symptoms in patients with dementia: A systematic review. *Arch Intern Med, 166,* 2182-2188.

Balk, E.M., Bonis, P.A.L., Moskowitz, H., Schmid, C.H., Ioannidis, J.P.A. Wang, C., & Lau, J. (2002) Correlation of Quality Measures with Estimates of Treatment Effect in Meta-analyses of Randomized Controlled Trials *JAMA.287*, No. 22

Baddeley, A., Eysenck, M., & Anderson, M. (2009). Memory. Psychology Press. Hove and New York.

Baddeley, A.D., & Wilson, B. (1988). Frontal amnesia and the dysexecutive syndrome. *Brain and Cognition, 7*, 212-230.

Ballard, C.G., O'Brien, J.T., Reichelt, K., & Perry, E.K. (2002). Aromatherapy as a safe and effective treatment for the management of agitation in severe dementia: The results of a double-blind, placebo-controlled trial with Melissa. *J CLin. Psychiatry*. 63(7), 553-558.

Barba, B.E., Tesh, A.S., & Courts, N.F. (2002). Promoting thriving in nursing homes: The Eden Alternative. *Journal of Gerontological Nursing, 28*(3), 7-13.

Barnicle, T. & Midden, K.S. (2003). The effects of a horticulture therapy program on psychological well-being of older people in a long term care facility. *HortTechnology.* 13 (1), 81-85.

Barrick, A., Sloane, P., Williams, C.,Mitchell, C.,Connell, B., Wood, W., Hickman, S., Preisser, J., & Zimmerman, S. (2010). Impact of ambient bright light on agitation in dementia. *Int J Geriatr Psychiatry.* 25, 1013–1021. DOI: 10.1002/gps.2453

Berman, M.G., Jonides, J., & Kaplan, S. (2008). The cognitive benefits of interacting with nature. *Psychological Science*, 19(12), 1207-1212.

Berto, R. (2005). Exposure to restorative environments helps restore attentional capacity. *J of Environmental Psychol,* 25, 249-239.

Berto, R. (2007). Assessing the restorative value of the environment: A study on the elderly in comparison with young adults and adolescents. International *Journal of Psychology. 42*. 5, 331-341. DOI: 10.1080/00207590601000590

Berto, R., Baroni, M.R., Zainaghi, A., & Bettella, S. (2010). An exploratory study of the effect of high and low fascination environments on attentional fatigue. *Journal of Environmental Psychology. 30,* 494-500. Doi: 10.1016/j.jenvp.2009.12.002

Berton, O., & Nestler, E.J. (2006). New approaches to antidepressant drug discovery: Beyond monoamines. *Nat Rev Neuroscience, 7*, 137-151.

Blau, T. (1977). Quality of life, social indicators, and criteria of change. *Prof Psychol* 8, 464– 473.

Bliwise, D.L., Lee, K., Carroll, J. & Dement, W. (1989) A rating scale for assessing sundowning in nursing home patients. *Sleep Res* 18, 408 (abstract). (ABRS)

Blegen, M.A., & Vaughn, C.J., Goode, Spector, T., & Park. J. (2013). Baccalaureate education in nursing and patient outcomes. *J Nurs Adm. 43*,2, 89-94. doi: 10.1097/NNA.0b013e31827f2028

Bossen, A. (2010). The importance of getting back to nature for people with dementia. *JGN* 36(2), 17-22.

Bradburn, N. M. (1969). The structure of psychological well-being. Chicago: Aldine.

Bradford Dementia Group. (1997). Evaluating dementia care: The DCM method. Bradford, UK: University of Bradford, Bradford Dementia Group.

Brodaty, H., & Finkel, S. I. (2003). Behavioral and Psychological Signs and Symptoms of Dementia. *Behavioral and Psychological Signs and Symptoms of Dementia*.

Bronnick, K., Ehrt, U., Emre, M., De Deyn, P.P., Wesnes, K., Tekin, S. & Aarsland, D. (2006). Attentional deficits affect activities of daily living in dementia-associated with Parkinson's disease. *J Neurol Neurosurg Psychiatry, 277*,1136–1142. doi: 10.1136/jnnp.2006.093146

Brooker, D.J., & Woolley, R.J. (2007). Enriching opportunities for people living with dementia: The development of a blueprint for a sustainable activity-based model. *Aging & Mental Health, 11,* 371-383.

Brown, V.M., Allen, A.C., Dwozen, M., Mercer, I., & Warren, K. (2004). Indoor gardening and older adults. *JGN. 30*(10), 34

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2009). *Introduction to Meta-Analysis*. West Sussex: Wiley.

Buchbauer, G. & Jirovetz, L. (1994). Aromatherapy: Use of fragrances and essential oils as medicaments. *Flavour and Fragrance Journal. 9*, 217-222.

Buckner, R.L., (2004). Memory and executive function in aging and AD: Multiple factors that cause decline and reserve factors that compensate. *Neuron. 44;* 195-208.

Buhr, G.T., & White, H.K. (2007). Difficult Behaviors in Long-term Care Patients with Dementia. *J Am Med Dir Assoc. 8,* E.101–E.113

Burgio, L., Sciley, K., Hardin, M., Hsu, C., & Yancey, J. (1996). Environmental "White noise": An intervention for verbally agitated nursing home

Burleigh, S., & Armstrong, C. (1997). On the scent of a useful therapy. *J Dement Care.*1997; **5**: 21–23.

Burns, A., Allen, H., Tomenson, B., Duignan, D., & Byrne, J. (2009). Bright light therapy for agitation in dementia: a randomized controlled trial. *International Psychogeriatrics*, *21*(4), 711.

Burns, A., Perry, E., Holmes, C., Frances, P., Morris, J., Howes, & Ballard, C. (2011). A double-blind placebo controlled randomized trial of Melissa officinalis oil and donepezil for the treatment of agitation in AD. *Dementia and geriatric cognitive disorders. 31*, 158-164.

Calkins, M., Szmerekovsky, J. G., & Biddle, S. (2007). Effect of increased time spent outdoors on individuals with dementia residing in nursing homes. *Journal of Housing for the Elderly, 21*(3-4), 211-228.

Cavanagh, H.M.A., & Wilkinson, J.M. (2002). Biological Activities of Lavender Essential Oil. *Phytother. Res.* 16, 301–308

Centers for Medicaid and Medicare. Accessed at www.cms.gov . press release, CMS May 30, 2012. Accessed 4/19/2013

Centers for Medicaid and Medicare Services, Nursing Home Compendium, 2010 edition. www.cms.gov. Accessed 4/19/2013

Chambliss, D.L., & Hollon, S.D. (1998). Defining empirically supported therapies. *Journal of Consulting and Clinical Psychology. 66*(1), 7-18.

Chapman, N.J., Hazen, T., & Noell-Waggoner, E. (2007). Gardens for people with dementia: Increasing access to the natural environment for residents with Alzheimer's. *Journal of Housing for the Elderly, 21,* 249-263.

Chi, I. & Boey, K.W., (1992) Validation of measuring instruments of mental health status of the elderly in Hong Kong. Department of Social Work & Social Administration, University of Hong Kong.

Cimprich, B. (1993). Development of an intervention to restore attention in cancer patients. *Cancer Nursing, 16*(2), 83-92.

Cimprich, B., & Ronis, D.L. (2001). Attention and symptom distress in women with and without breast cancer. *Nursing Research, 50*(2), 86-94.

Cimprich, B., & Ronis, D.L. (2003). An environmental intervention to restore attention in women with newly diagnosed breast cancer. *Cancer Nursing, 26*(4), 284-292.

Cioffi, J.M., Fleming, A., Wilkes, L., Sinfeild, & LeMiere, J. (2007). The effect of environmental change on residents with dementia. *Dementia. 6*(2), 215–231. DOI: 10.1177/1471301207080364

Coe, R. (2002). It's the effect size stupid: What effect size is and why it is important. Paper presented at the Annual Conference of the British Educational Research Association, University of Exeter, England, 12-14 September 2002

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*, 2nd Edition. Eriaum. Hillsdale NJ.

Cohen-Mansfield, J. (1999). Assessment and measurement of inappropriate behavior associated with dementia. *Journal of Gerontological Nursing, 25*(2), 42-51.

Cohen-Mansfield, J. (2000). Theoretical frameworks for behavior problems in dementia. *Alzheimer's Care Quarterly, 1*(4), 8-21

Cohen-Mansfield, J. (2001). Nonpharmacologic interventions for inappropriate behaviors in dementia: A review, summary, and critique. *Am J Geriatric Psychiatry, 9*, 361-381.

Cohen-Mansfield, J. (2007). Outdoor wandering parks for persons with dementia. *Journal of Housing for the Elderly, 21*(1-2), 35-53.

Cohen-Mansfield, J. and Billig, N. (1986). Agitated behaviors in the elderly: a conceptual review. *Journal of the American Geriatrics Society*, 34, 711–721.

Cohen-Mansfield, J., Libin, A., & Marx, M.S. (2007). "Nonpharmacological treatment of agitation: a controlled trial of systematic individualized intervention." *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 62(8),908-916.

Cohen-Mansfield, J., & Jensen, B. (2008). Assessment and treatment approaches for behavioral disturbances associated with dementia in the nursing home: self-reports of physicians' practices. *J Am Med Dir Assoc 9*,406–413.

Cohen-Mansfield, J., Marx, M., Freedman, L., Murad, H., Thein, K., & Dakheel-Alki, M. (2012). What affects pleasure in persons with advanced stage dementia? *Journal of Psychiatric Research, 46*, 402-406. DOI: 10.1016/j.jpsychires.2011.12.003

Cohen-Mansfield, J., Thein, K., Marx, M., Dakheel-Ali, M., Freedman, L. (2012). Efficacy of nonpharmacological interventions for agitation in advanced dementia: A randomized, placebo-controlled trial. *J Clin Psychiatry. 73*(9), 1255-1261. DOI: 10.4088/JCP.12m07918

Colenda, C.C., Cohen, W., McCall, W.V., & Rosenquist, P.B. (1997). Phototherapy for patients with Alzheimer's disease with disturbed sleep patterns: results of a community-based pilot study. *Alzheimer Dis Assoc Disord.* 11(3), 175-78.

Collier, L.M., McPherson, K., Ellis-Hill, C., Staal, J., & Bucks, R. (2010). Multisensory stimulation to improve functional performance in moderate to severe dementia-interim results. *American Journal of Alzheimer's Disease and Other Dementias. 25*(8), 698-703.

Collins, C.C. & O'Callaghan, A.M. (2008). The impact of HT of health indicators and quality of life in assisted living. *Hort Tech. 18*(4), 611

Comprehensive Meta-analysis software. Version 2. www.Meta-analysis.com

Concato, J., Shah, N., & Horwitz, R.I. (2000). Randomized, controlled trials, observational studies, and the hierarchy of research designs. *N Engl J Med 342*:1887-92.

Conn, V. (2004). Meta-analysis research. *J Vasc Nurs; 22*,51-52

Conn, V.S., & Rantz, M.J. (2003). Focus on Research Methods Research Methods: Managing Primary Study Quality in Meta-Analyses. *Research in Nursing & Health. 26,* 322–333. DOI: 10.1002/nur.10092

Conn, V.S., Valentine, J.C., Cooper, H.M., & Rantz, M.J. (2003). Grey literature in meta-analysis. *Nursing Research. 52*(4), 256-61.

Connell, B. R., Sanford, J. A., & Lewis, D. (2007). Therapeutic effects of an outdoor activity program on nursing home residents with dementia. *Journal of Housing for the Elderly,* 21(3-4), 195-209.

Csikszentmihalyi, M. (1990). Flow: The Psychology of Optimal Experience. New York, NY: Harper & Row.

Cummings, J. L., Mega, M., Gray, K., Rosenberg-Thompson, S., Carusi, D. A., & Gornbein, J. (1994). The Neuropsychiatric Inventory: Comprehensive assessment of psychopathology in dementia. *Neurology, 44*, 2308-2314.

Cutrona, C. & Russell, D. (1987). The provisions of socialization and adaptation to stress. *Advances in Personal Relationsihps.* 1. 37-67.

Day, K., Cameron, D., & Stump, C. (2000). The therapeutic design of environments for persons with dementia: A review of the empirical research. *The Gerontologist, 40*, 397-416.

Davis, S., Byers, S., Nay, R., & Koch, S. (2009). Guiding design of dementia friendly environments in residential care settings: Considering the living experiences. *Dementia*, *8*(2), 185-203.

Detweiler, M. B., Murphy, P.F., Kim, K.Y., Meyers, L.C., & Ashai, A. (2009). Scheduled medications and falls in dementia patients utilizing a wander garden. *American Journal of Alzheimer's Disease and Other Dementias,* 24(4), 322-332.

Detweiler, M.B., Murphy, P.F., Meyers, L.C., & Kim, K.Y. (2008). Does a wander garden influence inappropriate behaviors in dementia residents? *Am J Alzheimer's Disease Other Deme*, 23(1), 31-45.

Detweiler, M.B., Shasrma, T., Detweiler, J.G., Murphy, P.F., Lane, S., Carmen, J., Chudhary, A.S., Halling, M.H., & Kim, K.Y. (2012). What is the evidence to support the use of therapeutic gardens for the elderly? Psychiatry Investig. 9, 100-110.

Doty RL, Reyes PF, & Gregor, T. (1987). Presence of both odor identification and detection deficits in Alzheimer's disease. *Brain Res Bull*. 18:597–600.

Dowling, Z., Baker, R., Wareing, L.A., & Assey, J. (1997). Light, sounds, special effects. Journal of Dementia Care, 5(1), 16-18.

Duggan, S., Blackman, T., Martyr, A., & Van Schaik, P. (2008). The impact of early dementia on outdoor life: A 'shrinking world? Dementia (14713012), 7(2), 191-204.

Edris, A.E. (2007). Pharmaceutical and therapeutic potentials of essential oils and their individual volatile constituents: A Review. *Phytotherapy Research*. DOI: 10.1002/otr.2072

European Rating Aggression Group. (1992) Social dysfunction and aggression in generalized aggression and aggressive attacks: A validity and reliability study. *International Journal of Psychiatric Research.* 2, 15-29.

Fairjones, S.E., Vuletich, E.J., Pestell, C., & Penegyres, P.K. (2011). Exploring the role of cognitive reserve in early onset dementia. American Journal of Alzheimer's Disease & Other Dementias, 26(2), 139-144.

Feinstein, J.S., Duff, M.C., & Tranel, D. (2010). Sustained experience of emotion after loss of memory in patients with amnesia. *Proceedings of the National Academy of Sciences*, *107*(17), 7674-7679.

Felsten, G. (2009). Where to take a study break on the college campus: An attention restoration theory perspective. Journal of Environmental Psychology. 29(1), 160–167

Fetveit, A., Skjerve, A., & Bjorvatn, B. (2003). Bright light treatment improves sleep in institutionalised elderly - an open trial. *Int JGeriatr Psychiatry*. 18:520–6.

Folstein, M.F., Folstein, S.E., & McHugh, P.R. (1975). "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research;*12:189–198. [PubMed:1202204]

Forbes, D., Culum, I., Lischka,A,R., Morgan, D.G., Peacock, S., Forbes, J. & Forbes, S. (2009).Light therapy for managing cognitive, sleep, functional, behavioural, or psychiatric disturbances in dementia. Cochrane database of systematic reviews (Online) Cochrane Database Syst.Rev.,7-Oct-4 4.CD003946

Forbes, D., Morgan, D.G., Bangma, J., Peacock, S., Pelletier, N., Adamson, J. (2004). Light therapy for managing sleep, behaviour, and mood disturbances in dementia. Cochrane Database Syst.Rev.-2 2. CD003946

Fujii, M., Hatakeyama, R., Fukuoka, Y., Yamamoto, T., Sasaki, R., Moriya, M., Kanno, M., & Sasaki, H. (2008). Lavender aroma therapy for behavioral and psychological symptoms in dementia patients. *Geriatr Gerontol Int.* 8, *136–138.*

Gaugler, J.E., Kane, R.L., Kane, R.A, Clay, T., & Newcomer, R. (2003). Caregiving and institutionalization of cognitively impaired older people: Utilizing dynamic predictors of change. *The Gerontologist*. 43:219–229.

Gaugler, J.E., Edwards, A.B., Femia, E.E., Zarit, S.H., Stephens, M.A.P., Townsend, A., & Greene, R. (2000). Predictors of institutionalization of cognitively impaired older adults: Family help and the timing of placement. *Journal of Gerontology: Psychological Sciences, 55B*, P247–P256.

Gerlach-Spriggs, N., Kaufman, R., & Warner, S. (1998). *Restorative gardens: The healing landscape*. New Haven, CT: Yale University Press

Gibson, G., Chalfont, G.E., Clarke, P.D., Torrington, J.M., & Sixsmith, A.J. (2007). Housing and connection to nature for people with dementia: Findings from the INDEPENDENT project. *Journal of Housing for the Elderly*, 21(1-2), 55-72.

Gigliotti, C. & Jarrott, S. (2005). Effects of HT on engagement and affect. Canadian *Journal on Aging. 24*(4), 367

Gigliotti, C., Jarrott, S., & Yorgason, J. (2004). Harvesting Health: Effects of three types of horticulture therapy activities for persons with dementia. *Dementia*. 3(2),161-180.

Gottfries, C.G., Bråne, G., Gullberg, B., & Steen, G. (1982). A new rating scale for dementia syndromes. Archives of gerontology and geriatrics, 1(4), 311-321.

Grant, C.F., & Wineman, J.D. (2007). The garden-use model—An environmental tool for increasing the use of outdoor space by residents with dementia in long-term care facilities. *Journal for Housing for the Elderly, 21,* 89-115.

Gray, S. & Clair, A.A. (2002). Influence of aromatherapy on medication administration to residential-care residents with dementia and challenging behavoirs. *American Journal of Alzheimer's Disease and Other Dementias.* 17(3), 169-174.

Haffmans, P.M.J., Sival, R.C., Lucius, S.A.P., Cats, Q., & van Gelder, L. (2001). Bright light therapy and melatonin in motor restless behaviour in dementia: A placebo-controlled study. *Int J Geriatr Psychiatry* 16:106–110.

Hall, G.R., & Buckwalter, K.C., (1987). Progressively Lowered Stress Threshold: A conceptual model for care of older adults with Alzheimer's disease. Arch Psychiatr Nurs (13), 89-126.

Hanford, N., & Figueiro, M. (2012). Light therapy and Alzheimer's disease and related dementia: Past, present and future. *Journal of Alzheimer's Disease*. 1-10. Doi: 10.3233/JAD-2012-121645.

Hartig, T. & Staats, H., (2006). The need for psychological restoration as a determinant of environmental preferences. *Journal of Environmental Psychol.* 26, 215-226.

Heliker, D., Chadwick, A., & O'Connell, T. (2000). The Meaning of Gardening and the Effects on Perceived Well-Being of a Gardening Project on Diverse Populations of Elders. Activities, Adaptation & Aging,23(3), 35-56.

Hepburn, K.W., Lewis, M., Sherman, C.W., & Tornatore, J. (2003). The Savvy Caregiver Program: Developing and testing a transportable dementia family caregiver training program. *The Gerontologist*. 43:908–15. doi: 10.1093/geront/43.6.908

Herbison, P., Hay-Smith, J., & Gillespie, W.J. (2006). Adjustment of meta-analysis on the basis of quality scores should be abandoned. *Journal of Clinical Epidemiology, 59*, 1249-1256.

Herman, J. (1996). Shortcomings of the randomized control trial: a view from the boondocks. *Journal of Evaluation in Clinical Practice. 4*(4), 283-286.

Hernandez, R.O. (2007). Effects of therapeutic gardens in special care units for people with dementia: Two case studies. *Journal of Housing for the Elderly, 21*(1/2), 117-152.

Hertzog, C., Kramer, A. F., Wilson, R. S., & Lindenberger, U. (2008). Enrichment Effects on Adult Cognitive Development Can the Functional Capacity of Older Adults Be Preserved and Enhanced? *Psychological Science in the Public Interest*, *9*(1), 1-65.

Herzog, T.R., Black, A.M., Fountaine, K.A., & Knotts, D.J. (1997). Reflection and attentional recovery as distinct benefits of restorative environments. *Journal of Environmental Psychology*, 17, 165-170.

Herzog, T.R., Chen, H.C., & Primeau, J.S. (2002). Perception of the restorative potential of natural and other settings. *Journal of Environmental Psychology, 22*(3), 295-306.

Herzog, T.R., Colleen, P., Maguire, M., & Nebel, B. (2003). Assessing restorative the components of environments. *Journal of Environmental Psychology, 23,* 159-170.

Higgins, J.P., Thompson, S.G., Deeks, J.J., & Altman, D.G. (2003). Measuring inconsistency in meta-analyses. *BMJ: British Medical Journal*, *327*(7414), 557.

Holmes, C. (2002). Lavender oil as a treatment for agitated behavior in severe dementia: a placebo controlled trial. *Int J Geriatric Psychiatry. 17*(4), 305

Holt, F.E., Birks, T.P.H., Thorgrimsen, L M., Spector, A.E., Wiles, A., & Orrell, M. (2003). Aroma therapy for dementia. *Cochrane Database Syst Rev*, *3*. Art. No.: CD003150. DOI: 10.1002/14651858.CD003150.

Hunter, J. E., Schmidt, F. L., & Jackson, G. B. (1982). Meta-analysis: Cumulating research findings across studies. Beverly Hills, CA: Sage.

Inoue, M., Meshitsuka, S., Yoshioka, S. I., & Kawahara, R. (2000). Development of computerized screening system for dementia and its preliminary field test. *Computer methods and programs in biomedicine*, *61*(2), 151-155.

IOM (Institute of Medicine). 2011. *The Future of Nursing: Leading Change, Advancing Health.* Washington, DC: The National Academies Press.

International Psychogeriatrics Association (IPA). (2002). Psychological Symptoms of Dementia (BPSD) Educational Pack. *International Psychogeriatric Association*.

Jarrott, S.E., & Gigliotti, C. (2010). Comparing responses to horticultural-based and traditional activities in dementia care programs. *American Journal of AD and OD. 25*(8), 657-665

Jarrott, S.E., Kwack, H.R., & Relf, P.D. (2002). An observational assessment of a dementia specific HT program. *Hort Tech. 12*(3), 403

Jimbo, D., Kimura, Y., Taniguchi, M., Inoue, M., & Urkakami, K. (2009). Effect of aromatherapy on patients with Alzheimer's Disease. *Psychogeriatrics. 9,* 173-17.

Judge, K.S., Camp, C.J., & Orsulic-Jeras, S. (2000). Use of Montessori-based activities for clients with dementia in adult day care: effects on engagement. Am J Alzheimer's Dis Other Demen. 15:42-46.

Juni, P., Altman, D., & Egger, M. (2001). Assessing the quality of controlled clinical trials. *BMJ 323*(7), 42-46.

Kalis, A., Schermer, M.H., & van Delden, J.J. (2005). Ideals regarding a good life for nursing home residents with dementia: views of professional caregivers. *Nursing Ethics*, *12*(1), 30-42.

Kaplan, R. & Kaplan, S. (1989). In Kaplan S. (Ed.), The experience of nature: A psychological perspective. Cambridge; New York: Cambridge University Press.

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of environmental Psychology, 15*, 169-182.

Kaplan, S. (2001). Mediation, restoration, and the management of mental fatigue. *Environment and Behavior, 33*(4), 480-506.

Kaplan, S., & Berman, M. (2010). Directed Attention as a Common Resource for Executive Functioning and Self-Regulation. *Perspectives on Psychological Science. 5*, 43 DOI: 10.1177/1745691609356784

Kaplan, B.J., Giesbrecht, G., Shannon, S., & McLeod, K. (2011). Evaluating treatments in health care: The instability of a one-legged stool. *BMC Medical Research Methodology. 11*: 65

Kaplan, S., & Kaplan, R. (2003). Reviewing the evidence. health, supportive environments, and the reasonable person model. *American Journal of Public Health, 93*(9), 1484-1489.

Kamen, J., Fung, K.M., Tsang, H., & Chung, R. (2012). A systematic review of the use of aromatherapy in treatment of behavioral problems in dementia. *Geriatr Gerontol Int. 12*, 372-382.

Katoh, S., Simogaki, H., Onodera, A., Ueda, H., Oikawa, K., Ikeda, K., & Imai, Y. (1991). Development of the revised version of Hasegawa's Dementia Scale (HDS-R). *Jpn J Geriatr Psychiatry*, *2*, 1339-1347.

Kellert, S.R. & Wilson, O. (1993). The Biophilia hypothesis. Island Press. Washington, DC, Covelo, CA.

Kemperman, G., Gast, D., & Gage, F.H. (2002). Neuroplasticity in old age: Sustained fivefold induction of hippocampal neurogenesis by long-term environmental enrichment. *Annals of Neurology, 52*(2), 135-143.

Khachaturian, Z.S., Khachaturian, A.S., & Thies, W. (2012). The draft "National Plan" to address Alzheimer's disease-National Alzheimer's Project Act (NAPA). *Alzheimer's and Dementia*, *8*(3), 234-236.

Kilstoff, K. & Chenoweth, L. (1998). New approaches to health and well-being for dementia day-care clients, family carers and day-care staff. *International Journal of Nursing Practice*, *4*(2), 70-83.

Kim, S, Song, HH, and Yoo, SJ. (2003). The Effect of Bright Light on Sleep and Behavior in Dementia: An Analytic Review. Geriatr Nurs. 24,239-43

Knudsen, E., (2007). Fundamentals components of attention. *Annu Rev Neuorsci*. 30:57-78.

Kolanowski, A. M., Buettner, L., Costa, P. T., & Litaker, M. (2001). Capturing interests: Therapeutic recreation activities for persons with dementia. *Therapeutic Recreation Journal*, *35*(3), 220-235.

Kolanowski, A., Litaker, M., Buettner, L., Moeller, J., & Costa Jr, P.T. (2011). A Randomized Clinical Trial of Theory-Based Activities for the Behavioral Symptoms of Dementia in Nursing Home Residents. *J Am Geriatr Soc. 59*(6): 1032–1041. doi: 10.1111/j.1532-5415.2011.03449.x

Kolanowski, A.M., Fick, D.M., Clare, L., Therrien, B., & Gill, D. (2010). An intervention for delirium superimposed on dementia based on cognitive reserve theory. Aging & Mental Health, 14(2), 232-242.

Kolanowski, A.M., & Whall, A.L. (2000). Toward holistic theory-based intervention for dementia behavior. *Holistic Nursing Practice, 14,* 67-76.

Kong, E., Evans, L.K., & Guervara, J.P. (2009). Nonpharmacological intervention for agitation in dementia: A systematic review and meta-analysis. *Aging & Mental Health, 13*(4), 512-520.

Korpela, K. & Hartig, T., (1996). Restorative qualities of favorite places. *Journal of Environmental Psychology, 16,* 221-233.

Kovach, C.R., Taneli, Y., Dohearty, P., Schlidt, A.M., Cashin, S., & Silva-Smith, A.L. (2004). Effect of the BACE intervention on agitation of people with dementia. *The Gerontologist*, *44*(6), 797-806.

Kuo, F.E. & Sullivan, W.C. (2001). Aggression and violence in the inner city: Effects of environment via mental fatigue. Environment and Behavior, 33, 543–571.

Kutney-Lee, A., Sloane, D.M., & Aiken, L.H. (2013). An Increase in the number of nurses with baccalaureate degrees is linked to lower rates of postsurgery mortality. *Health Affairs 32*(3), 579-586. doi: 10.1377/hlthaff.2012.0504

LaGarce, M. (2002). Control of environmental lighting and its effects on behaviors of the Alzheimer's type. *Journal of Interior Design, 28*(2), 15-25.

Lagomasino, I.T., Dwight-Johnson, M., & Simpson, GM. (2005). The need for effectiveness trials to inform evidenced-based psychiatric practice. *Psychiatric Services. 56*(6), 649-651.

Lawton, M.P., Van Haitsma, K., & Klapper, J. (1996). Observed affect in nursing home residents with Alzheimer's disease. *Journal of Gerontology: Psychological Sciences, 51B*, P3–P14.

Lawton, M.P., Kleban, M.H., Dean, J., Rajagopal, D., & Parmelee, P.A. (1992). The factorial generality of brief positive and negative affect measures. *Journal of Gerontology: Psychological Sciences, 47*, P228-P237

Lee, Y. & Kim, S. (2008). Effects of indoor gardening on sleep, agitation, and cognition in dementia patients- a pilot study. *International Journal of Geriatric Psychiatry, 23*, 483-489.

Leung, S.O., Chan, C.C., & Shah, S. (2007). Development of a Chinese version of the Modified Barthel Index—validity and reliability. *Clinical Rehabilitation*, *21*(10), 912-922.

Lezak, M.D. (1995). Neuropsychological Assessment. (3rd Edition). New York: Oxford University Press.

Lin, P.W., Chan, W.C., Ng, B.F., & Lam, L.C. (2007). Efficacy of aromatherapy (lavandula angustifolia) as an intervention for agitated behaviours in Chinese older persons with dementia: A cross-over randomized trial. *International Journal of Geriatric Psychiatry, 22*(5), 405-410.

Lipsey, M.W. & Wilson, D.B. (2001). *Practical Meta-analysis: Applied Social Research Methods* Volume 49. (Bickman, L., Rog, D.J. Eds.) Sage publications. Thousand Oaks ,London, New Delhi.

Logsdon, R.G., McCurry, S.M., & Teri, L. (2005). STAR-caregivers: A community-based approach for teaching family caregivers to use behavioral strategies to reduce affective disturbances in persons with dementia. *Alzheimer's Care Quarterly, 6,* 146-153.

Logsdon, R.G., McCurry, S.M., & Teri, L. (2007). Evidence-based psychological treatments for disruptive behaviors in individuals with dementia. *Psychology & Aging, 22*(1), 28-36.

Lovell, B.B., Ancoli-Israel, S., & Gevirtz, R. (1995). Effect of bright light treatment on agitated behavior in institutionalized elderly subjects. *Psychiatry Research, 57*(1), 7-12.

Loving, R., Kripke, D., Knickerbocker, N., & Grandner, M. (2005). Bright green light treatment of depression for older adults [ISRCTN69400161]. *BMC psychiatry*, *5*(1), 42.

Lubben J.E., (1998) Assessing social networks among elderly populations. Family Community Health 11, 42–52.

Lyketsos, C.G. (2007). Neuropsychiatric symptoms (behavioral and psychological symptoms of dementia) and the development of dementia treatments. *International Psychogeriatrics / IPA, 19*(3), 409-420.

Lyketsos, C., Lopez, O., Jones, B., Fitzpatrick, A., Breitner, J., & DeKosky, S. (2002). Prevalence of neuropsychiatric symptoms in dementia and mild cognitive impairment: Results from the cardiovascular health study. *JAMA: Journal of the American Medical Association, 288*(12), 1475-1483

Lyketsos, C G., Samus, Q. M., Baker, A., McNabney, M., Onyike, C. U., Mayer, L. S., Brandt, J., Rabins, P., and Rosenblatt, A. (2007), Effect of Dementia and Treatment of Dementia on Time to Discharge from Assisted Living Facilities: The Maryland Assisted Living Study. *Journal of the American Geriatrics Society, 55*: 1031–1037. doi: 10.1111/j.1532-5415.2007.01225.x

Lyketsos, C.G., Veiel, L.L., Baker, A., & Steele, C. (1999). A randomized, controlled trial of bright light therapy for agitated behaviors in dementia patients residing in long-term care. *International Journal of Geriatric Psychiatry*, 14, 520-525.

Maci, T., Le Pirea, F., Quattrocchi, G., Di Nuovo, S., Perciavalle, V., & Zappia, M. (2012). Physical and cognitive stimulation in Alzheimer's disease. The GAIA Project: A pilot study. *American Journal of Alzheimer's Disease and Other Dementias. 27*(2), 107-113.

Mahoney, F.I. & Barthel, D.W. (1965). Functional evaluation: the Barthel Index. *Md State Med J.* 14, 61–65.

Martin, J.L., Webber, A.P., Alam, T., Harker, J.O., Josephson, K.R., & Alessi, C.A. (2006). Daytime sleeping, sleep disturbance, and circadian rhythms in the nursing home. *American Journal of Geriatric Psychiatry, 14,* 121-129.

McCurry, S.M., Reynolds, III C.F., Ancoli-Israel, S., Teri, L., & Vitiello, M.V. (2000). Treatment of sleep disturbances inAlzheimer's disease. *SleepMedicine Reviews**4***(6):603–628.

McEwen, B. (2007). Physiology and Neurobiology of Stress and Adaptation: Central Role of the Brain. *Physiol Rev* 87: 873–904, doi:10.1152/physrev.00041.2006.

McGough, J.J., & Faraone, S.V. (2009). Estimating the size of treatment effects: Moving beyond *p* values. *Psychiatry*. 6(10), 21-29.

McMinn, B.G., & Hinton, L. (2000). Confined to barracks: The effects of indoor confinement on aggressive behavior among inpatients of an acute psychogeriatric unit. *AM J ALZHEIMERS DIS OTHER DEMEN,15*: 36 DOI: 10.1177/153331750001500106

McShane, R., Gelding, K., Keene, J., Fairburn, C., Jacoby, R., & Hope, A. (2001) Getting Lost in Dementia: A Longitudinal Study of a Behavioral Symptom. *International Psychogeriatrics, Vol. 10, No. 3, 1998, pp.* 253-260.

Milev, R.V., Kellar, T., McLean, M., Mileva, V., Luthra, V. Thompson, S., et al. (2008). Multisensory stimulation for elderly with dementia: A 24-week single-blind randomized controlled pilot study. *American Journal of Alzheimer's Disease and Other Dementias, 24,* 372-376.

Mishima, K., Okawa, M., Hishikawa, Y., Hozumi, S., Hori, H., & Tkahashi, K. (1994). Morning bright light therapy for sleep and behavior disorders in elderly patients with dementia. *Acta Psychiatr Scand.*89:1-7.

Mishima, K.. Hishikawa, Y., & Okawa, M. (1998). Randomized, dimlight controlled, crossover test of morning bright light therapy for rest-activity rhythm disorders in patients with vasculardementia and dementia of Alzheimer's type. *Chronobiol Int. 15*(6): 647–654.

Moore, K.D. (2007). Restorative dementia gardens: Exploring how design may ameliorate attention fatigue. *Journal of Housing for the Elderly, 21*(1-2), 73-88.

Moorhead, S., Johnson, M., Maas, M.L., & Swanson, E. (2013). Nursing outcomes classification (NOC): Measurement of health outcomes (5th ed.). St. Louis: Elsevier-Mosby.

Morris, J.C. (2006). Mild cognitive impairment is early-stage Alzheimer disease. *Archives of Neurology, 63*(1), 15-16.

Morrison, J.H. & Hof, P.R. (1997). Life and death of neurons in the aging brain. *Science, 278,* 412-419.

Mungas, D., Weiler, P., Franzi, C., & Henry, R. (1989). Assessment of disruptive behavior associated with dementia: The disruptive behavior rating scales. *Journal of Geriatric Psychiatry and Neurology*. 2(4): 196-202**.**

Murman, D. & Colenda, C. (2005). The economic impact of neuropsychiatric symptoms in Alzheimer's disease: Can drugs ease the burden? *Pharmacoeconomics, 23*, 227-234.

Murphy, C., Gilmore, M.M., Seery CS, Salmon DP, Lasker, BR. (1990). Olfactory thresholds are associated with degree of dementia in Alzheimer's disease. *Neurobiol Aging* 1990;11:465–9.

Namazi, K.H., & Johnson, B.D. (1992). Pertinent autonomy of residents with dementias: Modification of the physical environment to enhance independence. *American Journal of Alzheimer's Disease and Other Dementias, 7,* 16-21.

Nightingale, F. (1971). To the probationer nurses in the Nightingale Fund School at St. Thomas' Hospital. *International Nursing Review, 18*(1), 3-5.

Nowak, L. & Davis, J. (2011). Qualitative analysis of therapeutic light effects on global function in Alzheimer's Disease. *Western Journal of Nursing Research. 33*(7), 933-952.

Norman, D.A., & Shallice, T. (2000). Attention to action: Willed and automatic control of behaviour. In M.S. Gazzaniga (Ed.), Cognitive neuroscience: A reader (pp. 376–390). Malden, MA: Blackwell.

Nguyen, Q. & Paton, C. (2008). The use of aromatherapy to treat behavioural problems in dementia. *Int J of Geriatric Psychiatry. 23,* 337.

O'Brien, J.A., Shomphe, L.A., & Caro, J.J. (2000). Behavioral and psychological symptoms of dementia in nursing home residents: The economic implications. *International Psychogeriatrics, 12,* 51-57.

O'Brien, J., Shomphe, L.A., Kavanagh, P. L., Raggio, G., & Caro, J. J. (1998). Direct medical costs of complications resulting from type 2 diabetes in the U.S. *Diabetes Care, 21*(7), 1122-1128.

O'Connor, D.W., Ames, D., Gardner, B., & King, M. (2009). Psychosocial treatments of behavior symptoms in dementia: a systematic review of reports meeting quality standards. *International psychogeriatrics / IPA.* Apr 21(2):225-240.

Olazarán, J., Reisberg, B., Clare, L., Cruz, I., Peña-Casanova, J., Del Ser, T., Woods, B., Beck, C., Auer, S., Lai, C., Spector, A., Fazio, S., Bond, J., Kivipelto, M., Brodaty, H., Rojo, J.M., Collins, H., Teri, L., Mittelman, M., Orrell, M., Feldman, H.H., & Muñiz, R.. (2010). Nonpharmacological therapies in Alzheimer's disease: a systematic review of efficacy. *Dement Geriatr Cogn Disord. 30*(2):161-78. doi: 10.1159/000316119. Epub 2010 Sep 10.

O'Neil, M., Freeman, M., Christensen, V., Telerant, A., Addleman, A., & Kansagara, D. (2011). Non-pharmacological Interventions for Behavioral Symptoms of Dementia: A Systematic Review of the Evidence. VA-ESP Project #05-225;

Okawa, M., Hishikawa, Y., Hozumi, S., & Hori, H. (1991). Sleep-wake rhythm disorder and phototherapy in elderly patients with dementia. *Biol Psychiatry1:*837-40.

Orlitzky, M. (2012). How can significance tests be deinstitutionalized?. *Organizational Research Methods*, *15*(2), 199-228.

Ottosson, J. & Grahn, P. (2005). A comparison of leisure time spent in a garden with leisure time spent indoors: On measures of restoration in residents in geriatric care. *Landscape research. 30*(1),23-55.

Parasuraman, R. & Haxby, J.V. (1993). Attention and brain function in Alzheimer's disease: A review. *Neuropsychology, 7*(3), 242-272.

Pebble Project. http://www.healthdesign.org/pebble. Accessed 4/9/2013.

Perry, J.R., & Hodges, J.R. (1999). Attention and executive deficits n Alzheimer's disease: A critical review. *Brain, 122*, 383-404.

Petrosini, L., De Bartola, P., Foti, F., Gelfo, F., Cutuli, D., Leggio, M.G., et al., (2009). On whether the environmental enrichment may provide cognitive and brain reserves. *Brain Res News, 61*, 221-239.

Providence Benedictine Gardens. http://oregon.providence.org/patients/programs/providence-benedictine-child-development-center/pages/storieslanding.aspx?name=therapy+garden+blossoms&type=stories&ensid=39. Accessed 4/9/2013

Rappe, E. & Topo, P. (2007). Contact with outdoor greenery can support competence among people with dementia. *Journal of Housing for the Elderly, 21*(3-4), 229-248.

Reimer, M.A., Slaughter, S., Donaldson, C., Currie, G., & Eliasziw, M. (2004). Special care facilities compared with traditional environments for dementia care: A longitudinal study of quality of life. *Journal of the American Geriatrics Society, 52*, 1085-1092.

Reimersma,-van der Lek, R.F., Swaab, D.F., Twisk, J., Hol, E.M., Hoogndijk, W.J., & Van Someren, E.J. (2008). Effect of bright light and melatonin on cognitive and noncognitive function in elderly residents of group care facilities. *JAMA, 299*(22), 2642-2655.

Reisberg, B. (1987). Functional assessment staging (FAST). *Pychopharmacology bulletin*, *24*(4), 653-659.

Reisberg, B., Borenstein, J., Salob, S.P., Franssen, E., & Georgotas, A. (1987). Behavioural symptoms in Alzheimer's disease: Phenomenology and treatment. *J. Clin. Psychiatry*;48: 9–15.

Rilely-Doucet, C.K. (2009). Use of multisensory environments in the home for people with dementia. *Journal of Gerontological Nursing*, 35(5), 42-52.

Reker, G.T., & Peacock, E.J. (1981). The Life Attitude Profile (LAP): A multidimensional instrument for assessing attitudes toward life. *Canadian Journal of Behavioural Science*, *13*, 264-273.

Rodiek, S. (2002). Influence of an outdoor garden on mood and stress in older adults. *Journal of Therapeutic Horticulture, 8*, 14-21.

Roe, C.M., Xiong, C., Miller, J.P., & Morris, J.C. (2007). Education and Alzheimer's disease without dementia: Support for the cognitive reserve hypothesis. *Neurology, 68*(3), 223-228.

Rosen, J., Burgio, L., Kollar, M., Cain, M., Allison, M., Fogleman, M., et al. (1994). The Pittsburg Agitation Scale: a user friendly instrument for rating agitation in dementia patients. *Am J Ger Psych* 2: 52–59.

Rosen W.G., Mohs, R.C., & Davis, K.L. (1984). A new rating scale for Alzheimer's disease. *Am J Psychiatry.* 141, 1356–1364.

Russell, C. (1996) UCLA Loneliness Scale (version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment. 66*(1) 20-40.

Sakamoto, Y., Ebihara, S., Ebihara, T., Tomita, N., Toba, K., Freeman, S,. & Kohuski, M. (2012). Fall prevention using olfactory stimulation with lavender odor in elderly nursing home residents: A randomized controlled trial. *JAGS, 60*, 1005-1011. DOI: 10.1111/j.1532-5415.2012.03977.x

Salzman, C., Jeste, D., Meyer, R.E., Cohen-Mansfield, J., Cummings, J., Grossberg, G., Jarvik, L., Kraemer, H., Lebowitz, B., Maslow, K., Pollock, B., Raskind, M., Schultz, S., Wang, P., Zito, J.M., & Zubenko, G.S. (2008). Elderly Patients with Dementia-Related Symptoms of Severe Agitation and Aggression: Consensus Statement on Treatment Options, Clinical Trials Methodology, and Policy. *J Clin Psychiatry. 69(*6): 889–898. PMCID: PMC2674239

Samus, Q.M., Rosenblatt, A., Onyike, C., Steele, C., Baker, A., Harper, M., Brandt, J., Mayer, L., Rabins, P.V., & Lyketsos, C.G. (2006). Correlation of caregiver rated quality of life in assisted living: The Maryland Assisted Living Study. *Journal of Gerontology: Psycho Sci.,* 61(5), P311-P314.

Samus, Q.M., Rosenblatt, A., Steele, C., Baker, A., Harper, M., Brandt, J., Mayer, L., Rabins, P.V., & Lyketsos, C.G. (2005). The association of neuropsychiatric symptoms and environmental quality of life in assisted living residents. *The Gerontologist*, (Special edition) 19-26.

Satlin, A., Volicer, L., Ross,V., Herz, L., & Campbell, S. (1992). Bright light treatment of behavioral and sleep disturbances in patients with Alzheimer's disease. *Am.J.Psychiatry, 149*(8), 1028-1032

Schindler, S.D., Graf, A., Fischer, P., Tölk, A., & Kasper, S. (2002). Paranoid delusions and hallucinations and bright light therapy in Alzheimer's disease. *Int J Geriatr Psychiatry. 17*(11),1071-2.

Schmidt, F. (2008). Meta-analysis: A constantly evolving research integration tool. *Organizational Research Methods. 11*(1), 96-113.

Schneider, L.S., Dagerman, K.S., & Insel, P. (2005). Risk of death with atypical antipsychotic drug treatment for dementia: meta-analysis of randomized placebo- controlled trials. *JAMA*.294:1934- 1943.

Schneider, L.S., Olin, JT., Lyness, S.A., & Chui, H.C. (1997). Eligibility of Alzheimer's disease clinic patients for clinical trials. *J Am Geriatr Soc. 45*(8),923-8.

Schneider, L.S., Tariot, P.N., Dagerman, K.S., Davis, S.M., Hsiao, J.K., Ismail, M.S., Lebowitz, B.D., Lyketsos, C.G., Ryan, J.M., Stroup, T.S., Sultzer, D.L., Weintraub, D., Lieberman, J.A.; CATIE-AD Study Group.(2006). Effectiveness of atypical antipsychotic drugs in patients with Alzheimer's disease. *N Engl J Med. 12*;355(15):1525-38.

Schoefield, P. (2002). Evaluating snoezelen for relaxation within chronic pain management. *British Journal of Nursing, 11*, 812-821.

Schölzel-Dorenbos, C.J., Ettema, T.P., Bos, J., Boelens-van der Knoop, E., Gerritsen, D.L., Hoogeveen, F., de Lange, J., Meihuizen, .L, Dröes, R.M. (2007). Evaluating the outcome of interventions on quality of life in dementia: selection of the appropriate scale. *Int J Geriatr Psychiatry. 22*(6):511-9.

Snow, A.L., Havanec, L., & Brandt, J. (2004). A controlled trial of aromatherapy for agitation in nursing home patients with dementia. *The Journal of Complementary and Alternative Medicine. 10*(3). 431-437.

Seitz, D.P., Brisbin, S., Herrmann, N., Rapoport, M.J., Wilson, K., Gill, S.S., Rines, J., Le Clair, K., & Conn, D. (2012). Efficacy and feasibility of nonpharmacological interventions for neuropsychiatric symptoms of dementia in long term care: a systematic review. *Journal of the American Medical Directors Association. 13*(6),503-506 e502.

Shirani, & St. Louis, EK. (2008). Illuminating Rationale and Uses for Light Therapy. *J Clin Sleep Med.* 5(2),155-163.

Skjerve,A. Bjorvatn,B. & Holsten,F. (2004). Light therapy for behavioural and psychological symptoms of dementia. *International Journal of Geriatric Psychiatry, 19* (6), 516-522.

Skjerve, A., Holsten, F., Aarsland, D., Bjorvatn, B., Nygaard, H.A., & Johansen, I.M. (2004). Improvement in behavioral symptoms and advance of activity acrophase after short-term bright light treatment in severe dementia. *Psychiatry Clin.Neurosci., 58*(4), 343-347.

Smallwood, J., Brown, R., Coulter, F., Irvine, E., & Copland, C. (2001). Aromatherapy and behaviour disturbances in dementia: a randomized controlled trial. *International Journal of Geriatric Psychiatry*, *16*(10), 1010-1013.

Smith, S.C., Lamping, D.L., Banerjee, S., Harwood, R., Foley, B., Smith, P., & Knapp, M. (2005). Measurement of health-related quality of life for people with dementia: development of a new instrument (DEMQOL) and an evaluation of current methodology. *Health Technology Assessment (Winchester, England)*, *9*(10), 1.

Snow, L.A., Hovanec, L., & Brandt, J. (2004). A controlled trial of aromatherapy for agitation in nursing home patients with dementia. *The Journal of Alternative and Complementary Medicine*, *10*(3), 431-437.

Sotiropolous, I., Cerqueira, J.J., Catania, C., Takashima, A., Sousa, N., & Almeida, O.F.X. (2008). Stress and glucocorticoid footprints in the brain-The path from depression to Alzheimer's disease. *Neuroscience and Biobehavioral Reviews, 32,* 1161-1173.

Specht, J.K., Taylor, R., & Bossen, A.L. (2009). Partnering for care: the evidence and the expert. *Journal of gerontological nursing*, *35*(3), 16-22.

Spijker, A., Vernooij-Dassen, M., Vasse, E., Adang, E., Wollersheim, H., Grol, R., et al. (2008). Effectiveness of nonpharmacological interventions in delaying the institutionalization of patients with dementia: A meta-analysis. *Journal of the American Geriatrics Society, 56*(6), 1116-1128.

Stern, Y. (2009). Cognitive reserve. *Neuropsychologia, 47*(10), 2015-2028.

Stern, Y. (2002). What is cognitive reserve? Theory and research application of the reserve concept. *Journal of the International Neuropsychological Society, 8*(3), 448-460.

Sugiyama, T. & Ward-Thompson, C. (2007). Outdoor environments, activity and the well-being of older people: Conceptualizing environmental support. *Environment and Planning, A 39,* 1943-1960.

Tennessen, C.M. & Cimprich, B., (1995). Views to nature: Effects on attention. *J Environmental Psychol., 15*, 77-85.

Teri, L., McCurry, S.M., Logsdon, R., & Gibbons, L.E. (2005). Training community consultants to help family members improve dementia care: a randomized controlled trial. *The Gerontologist*, *45*(6), 802-811.

Thomas, D.W., Glogoski, C., & Johnson, J. (2007). The effect of a supervised walking program on wandering among residents with dementia. *Activities, Adaptation, & Aging, 30*(4), 1-13.

Thomas, W.H. (1994). *The Eden alternative: Nature, hope and nursing homes.* Sherburne, NY: Eden Alternative Foundation.

Thorgrimsen, L.M., Spector, A.E., Wiles, A., & Orrell, M. (2003). Aroma therapy for dementia. *Cochrane Database of Systematic Reviews* Issue 3. DOI: 10.1002/14651858.CD003150

Thorpe, L., Middleton, J., Russell, G., & Stewart, N. (2000). Bright light therapy for demented nursing home patients with behavioral disturbance. *Am J Alzheimer's Dis. 15*:18–26.

Tse, M.M.Y., (2010). Therapeutic effects of an indoor gardening programme for older people living in nursing homes. *Journal of Clinical Nursing, 19*, 949–958 949 doi: 10.1111/j.1365-2702.2009.02803.x

Turner, S. (2005). Behavioural symptoms of dementia in residential settings: A selective review of non-pharmacological interventions Aging & Mental Health, 9(2): 93–104

Ulrich, R. (1984). View through a window may influence recovery from surgery. Science. 224(4647), 420.

Vance, D.E. (2003). Implications of Olfactory Stimulation in Activities for Adults with Age-Related Dementia. *Activities, Adaptation & Aging, 27*(2), 17-25.

Van den Berg, A.E. & Custers, H.G. (2011). Gardening promotes neuroendocrine and affective restoration from stress. *Journal of Health Psychology, 16*(1), 3-11.

Van Deipen, E., Baillon, S.F., Redman, J., Rooke, N., Spencer, D.A. & Prettyman, R. (2002). A pilot study of the physiological and behavioral effects of snoezelen in dementia. *British Journal of Occupational Therapy, 65*, 61-66.

van Someren, E.J.W., Kessler, A., Mirmiran, M., & Swaab, D.F. (1997). Indirect bright light improves circadian rest-activity rhythm disturbances in demented patients. *Biol Psychiatry. 41*,955–63

Velarde, M.D., Fry, G., & Tveit, M. (2007). Health effects of viewing landscapes-Landscape types in environmental psychology. *Urban Forestry and Urban Greening. 6*, 199-212.

Verstraten, P.J.F., van Eekelen, C. (1988). Handleiding voor de GIP, gedragsobservatie-schaal voor de intramuralepsychogeriatrie. (Behavioral rating scale for psycho-geriatric inpatients). Van Loghum Slaterus: Deventer, The Netherlands.

von Gunten, A., Alnawaqil, A.M., Abderhalden, C., Needham, I., & Schupbach, B. (2008). Vocally disruptive behavior in the elderly: A systematic review. *International Psychogeriatrics, 20,* 653-672.

Wake, G., Pickering, A., Lewis, R., Wilkins, R., & Perry, E. (2000). CNS acetylcholine receptor activity in European medicinal plants traditionally used to improve failing memory. *Journal of ethnopharmacology*, *69*(2), 105-114.

Walach, H., Falkenberg, T., Fonnebo,V., Lewith, G., & Jonas, W.B. (2006). Circular instead of hierarchical: Methodological principles for the evaluation of complex interventions. *BMC Medical Research Methodology. 6,* 29. DOI: 10.1186/1471-2288-6-29

Wang, P.S., Schneeweiss, S., Avorn, J., Fischer, M.A., Mogun, H., Solomon, D.H., & Brookhart, M.A. (2005). Risk of Death in Elderly Users of Conventional vs. Atypical Antipsychotic Medications. *N Engl J Med 353*, 2335-41.

Ward-Smith, P., Llanque, S.M., & Curran, D. (2009). The effect of multisensory stimulation on persons residing in an extended care facility. *American Journal of Alzheimer's Disease and Other Dementias, 24*(6), 450-455.

Wells, K.B. (1999). Treatment research at the crossroads: The scientific interface of clinical trials and effectiveness research. *Am J Psychiatry. 156*(1), 5-10.

Whall, A.L., Black, M.E., Groh, C.J., Yankou, D.J., Kupferschmid, B.J., & Foster, N.L. (1997). The effect of natural environments upon agitation and aggression in late stage dementia patients. *American Journal of Alzheimer's Disease, 12*(5), 216-220.

Wilson, E.O. (1984). *Biophilia*. Cambridge, MA, Harvard University Press.

Wong, R.O.L. & Ghosh, A. (2002). Activity-dependent regulation of dendritic growth and patterning. *Nature Reviews, Neuroscience, 3*(10), 803-81.

Woods, B., Spector, A.E., Jones, C.A., Orrell, M., Davies, S.P. (2005). Reminiscence therapy for dementia. *Cochrane Database of SystematicReviews*, Issue 2. Art. No.: CD001120. DOI: 10.1002/14651858.CD001120.pub2.

Woods, B., Thorgrimsen, L., Spector, A., Royan, L., & Orrell, M. (2006). Improved quality of life and cognitive stimulation therapy in dementia. *Aging and Mental Health*, *10*(3), 219-226.

Yamandera, H., It, T., Suzuki, H., Asayama, K., Ito, R., & Endo, S. (2000). Effects of bright light on cognitive and sleep-wake (circadian) rhythm disturbances in Alzheimer-type dementia. *Psychiatry Clin Neurosci 54*: 352–353.

Yao, L., & Algase, D. (2006). Environmental ambiance as a new window on wandering. *Western Journal of Nursing Research, 28,* 89-104.

Yasukawa, M. (2009) Horticultural Therapy for the Cognitive Functioning of Elderly People with Dementia. In (ed. Ingrid Soderberg) *International Handbook of Occupational Therapy Interventions.* Ch. 46, 431-443. Springer Dordrecht Heidelberg London New York. DOI: 10.1007/978-0-387-75424-6

Zeisel, J. (2005). Environment, neuroscience and Alzheimer's disease. *Alzheimer's Care Quarterly, 6,* 273-279.

Zeisel, J., Silverstein, N.M., Hyde, J., Levkoff, S., Lawton, M.P., & Holmes, W. (2003). Environmental correlates to behavioral health outcomes in Alzheimer's special care units. *The Gerontologist, 43,* 697-711. Copyright© SLACK Incorporated

Zito, K., & Svoboda, K. (2002). Activity-dependent synaptogenesis in the adult mammalian cortex. *Neuron, 35*(6), 1015-1017.