

Pain of Osteoarthritis in Women: Environment Research

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## **Dedication**

This dissertation is dedicated to my husband  
for his support and encouragement  
throughout this long journey  
and  
to my daughters  
who inspire me every day.

University of Washington

**Abstract**

Pain of Osteoarthritis in Women: Environment Research

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Family and Child Nursing

Older women with osteoarthritis (OA) need effective pain management strategies.

Distraction, a strategy known to be effective, may be facilitated through environmental stimuli (specifically, multi-sensory stimuli from nature). The study aims were to explore outdoor symptom experiences of women with OA, compare pain symptom experiences in outdoor spaces with a higher versus lower level of multi-sensory nature (M-SN), describe amount of time spent in higher/lower M-SN spaces by women (based on OA, bodily pain, and functional status), and develop a situation-specific model for future research.

This cross-sectional descriptive study, using Symptom Management Theory as the conceptual framework, involved four retirement community study sites with two outdoor spaces (e.g., a courtyard) measured objectively as having higher/lower M-SN levels. Qualitative (directed content analysis of interview texts) and quantitative (statistical analysis of self-administered survey items) methods were then used. Integration of qualitative and quantitative findings enabled development of a situation-specific model.

Analysis of qualitative data (N=16 women with OA) provided descriptive themes regarding outdoor experiences of older women with OA and uncovered two concepts: Sense of Well-being Outdoors and Person-Environment Relation. However, these data were insufficient to compare OA pain experiences in higher/lower M-SN spaces. Quantitative data (N=276

women with/without OA), analyzed with two-way fixed-effects ANOVA, showed no difference in the amount of time spent in higher/lower M-SN spaces by person factors (OA, bodily pain or functional status) analyzed separately. Exploratory analyses showed that women spent significantly less overall time outdoors if they had OA ( $p=.03$ ), greater bodily pain ( $p=.001$ ), or lower functional status ( $p<.001$ ). Additionally, t-tests demonstrated that women with OA reported spending significantly fewer days outdoors per week ( $p=.005$ ), but a similar amount of time outdoors on days when they went outside ( $p=.27$ ). A situation-specific model of an environment-based pain management strategy for older women with OA, derived from Symptom Management Theory, was developed.

The negative impact of OA on women's overall time spent outdoors and the use of multi-sensory stimuli to distract from OA pain merit further study. Ultimately, this work may lead to strategies for pain self-management involving outdoor environments and evidenced-based design recommendations for senior-living communities.

## TABLE OF CONTENTS

	Page
LIST OF TABLES .....	iv
LIST OF FIGURES .....	v
Chapter 1: INTRODUCTION.....	1
Pain of Osteoarthritis in Women: Environment Research Study.....	3
Implications.....	6
Chapter 2: REVIEW OF LITERATURE .....	7
Conceptual Framework: Symptom Management Theory.....	7
<i>Health</i> .....	13
<i>Person</i> .....	23
<i>Environment</i> .....	26
Conclusion .....	30
Chapter 3: "CONTACT WITH NATURE" AND HEALTH .....	31
"Contact with Nature" .....	31
Studies of Nature and Health .....	35
Conclusion .....	41
Chapter 4: MEASUREMENT OF NATURE IN OUTDOOR SPACES .....	42
Background.....	43
Instrument Development.....	45
Methods for Measuring Environment in the POWER Study.....	53
Discussion.....	60
Conclusion .....	62

	Page
Chapter 5: OLDER WOMEN WITH OSTEOARTHRITIS	
IN OUTDOOR ENVIRONMENTS .....	64
Background.....	65
Methods.....	67
Results.....	76
Discussion.....	84
Conclusion .....	88
Chapter 6: TIME SPENT OUTDOORS BY WOMEN	
WITH AND WITHOUT OSTEOARTHRITIS .....	89
Methods.....	89
Results.....	98
Discussion.....	108
Conclusion .....	111
Chapter 7: BUILDING A SITUATION-SPECIFIC MODEL .....	113
Background.....	114
Methods.....	116
Results.....	118
Discussion.....	125
Concluding Remarks.....	127
REFERENCES .....	130
APPENDIX A: Multi-sensory Nature Addendum.....	148
APPENDIX B: Description of Outdoor Spaces at each Study Site.....	153

	Page
APPENDIX C: Phase 1 - Background Information Form .....	155
APPENDIX D: Phase 1 - Interview Guide .....	158
APPENDIX E: Phase 2: POWER Study Survey .....	164

## LIST OF TABLES

	Page
Table 1.1. Summary of POWER Study Design .....	6
Table 3.1. Randomized Control Trials on the Influence of Nature on Pain .....	38
Table 4.1. ANOET-R Item Revision and New Item Examples .....	49
Table 4.2. Inter-rater Reliability for the Access to Nature Evaluation Tool-Revised .....	58
Table 4.3. Summary Description of Selected Spaces at each Study Site .....	60
Table 5.1. Interview Questions Linked to Symptom Management Theory Concepts .....	72
Table 5.2. Coding Manual Example: <i>Symptom Experience</i> Construct with Selected Codes	75
Table 5.3. Sample Characteristics .....	77
Table 5.4. Themes Describing <i>Symptom Experiences</i> of Women in Outdoor Environments .....	78
Table 5.5. Themes Describing Person-Environment Relation of Women in Outdoor Environments .....	79
Table 6.1. Examples of Multi-sensory Nature Items in Access to Nature Outdoor Environment Tool – Revised .....	91
Table 6.2. POWER Study Survey Item Examples and Response Options .....	93
Table 6.3. Sample Characteristics by Osteoarthritis Status .....	101
Table 6.4. Score Ranges for Bodily Pain and Functional Status Groups .....	105
Table 6.5. Analysis of Variance for Time Spent in Space with Higher versus Lower Level of Multi-sensory Nature .....	106
Table 6.6. Analysis of Variance for Overall Time Spent Outdoors .....	108
Table 7.1. Study Phase and Symptom Management Theory (SMT) Constructs .....	117

## LIST OF FIGURES

	Page
Figure 2.1. Symptom Management Model .....	9
Figure 4.1. Overall and Nature Dimension Scores on Original ANOET and New ANOET-R .....	51
Figure 4.2. ANOET Contact with Nature Scores .....	52
Figure 4.3. ANOET-R Multi-sensory Nature Scores.....	52
Figure 4.4. Retirement Community Study Site Screening.....	55
Figure 4.5. Multi-sensory Nature Dimension Space Scores at Potential POWER Study Sites .....	57
Figure 5.1. Screening of Participants .....	70
Figure 5.2. Person-Environment Relation and Symptom Experience: Perception .....	81
Figure 6.1. Percentage of Women who Spend at Least 30 Minutes Outdoors per Week .....	102
Figure 6.2. Time Spent in Outdoor Spaces with a Higher versus Lower Level of Multi-sensory Nature .....	103
Figure 6.3. Time Spent in Outdoor Retirement Community Spaces with a Higher Level of Multi-sensory Nature.....	104
Figure 6.4. Time Spent in Outdoor Retirement Community Spaces with a Lower Level of Multi-sensory Nature .....	104
Figure 7.1. Symptom Management Model Figure .....	120
Figure 7.2. Overview of the Situation-specific Model: Derived from Symptom Management Theory.....	122

Figure 7.3. Situation-specific Model: Older Women with Osteoarthritis Pain in  
Outdoor Environments.....123

## Chapter 1

### INTRODUCTION

Approximately 27 million people in the United States have osteoarthritis (OA), a painful chronic disease that rises in prevalence with age.<sup>1</sup> The incidence of age-related diseases, such as OA, is expected to increase as the number of adults 65 years and older is predicted to rise by 36% over the next decade.<sup>2</sup> In addition, while the ratio of women to men 65 years of age is nearly equal, by 85 years and older this ratio rises to more than 2 to 1.<sup>2</sup> Older women have a higher rate of OA and co-morbidities, and higher prevalence of most chronic pain conditions compared to men.<sup>3-5</sup> This circumstance places women at higher risk than men of polypharmacy (use of multiple medications) and, consequently, higher risk of medication side effects, adverse reactions, and interactions. Therefore, older women are especially in need of nondrug strategies for pain from OA.

Pain is a symptom, an experience that is measured and evaluated based on one's perception (i.e., self-report), as opposed to a sign of disease that can be measured objectively.<sup>6</sup> The definition of pain as a perception is consistent with the International Association for the Study of Pain (IASP) Taxonomy, which defines pain as an "unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (IASP Taxonomy, term 1).<sup>7</sup> The IASP Taxonomy provides definitions for pain-related terms. However, in addition, IASP advises authors to define their terms, as there is variation in pain terminology in both research and clinical literature. The phrase "OA pain" in this dissertation, therefore, is defined as the persistent pain associated with OA. The American Geriatrics Society currently recommends using the term "persistent pain" rather than "chronic pain."<sup>8</sup> OA pain includes pain that is due to tissue damage and pain due to peripheral and central

sensitization (e.g., sensitization as indicated by hyperalgesia and allodynia).<sup>9</sup> Hyperalgesia is defined by the IASP as "increased pain from a stimulus that normally provokes pain" (IASP Taxonomy, term 8).<sup>7</sup> Allodynia is defined by the IASP as pain "due to a stimulus that does not normally provoke pain" (IASP Taxonomy, term 2).<sup>7</sup>

Pain management strategies can include environment-based interventions.<sup>10</sup>

Interventions designed to influence health through changing the physical environment have been identified as important and strategic approaches for promoting health.<sup>11</sup> There is a well-established association between the built environment of a neighborhood and health, as demonstrated by studies linking environment characteristics to physical activity, nutrition, obesity, and depression.<sup>12-15</sup> Health research on the built environment is advancing through use of more valid and reliable tools that measure environment characteristics. Measurement that is more accurate facilitates examination of the associations between health or health-related behaviors and environment characteristics.<sup>12</sup>

Nature, a component of the aesthetic dimension of environment, has been identified as an aspect of environment that may benefit health; however, most environment measures used in health sciences research are limited in the number of items related to nature.<sup>16, 17</sup> In fact, a review of the aesthetic (or pleasurability) subscale in two built environment instruments,<sup>18, 19</sup> as well as publications describing instruments that assess nursing home environments,<sup>20-22</sup> incorporate limited (if any) attention to measurement of the aesthetic dimension of the outdoor environment. The frequently referenced health benefits of nature (e.g., in relation to "healing gardens") lack systematic study regarding how and for whom contact with nature might improve health.<sup>10, 23, 24</sup> Reduction of pain through the mechanisms of distraction and reduced stress has been proposed as a way that nature might improve health.<sup>25</sup> Although nature-related stimuli (i.e.,

audio or visual recordings) have been shown to reduce acute pain in clinical settings,<sup>26</sup> there are no studies that directly examine whether contact with nature in an outdoor environment influences pain from OA. Because distraction from pain may be facilitated through environmental stimuli<sup>10</sup> and nature provides engaging multi-sensory stimuli that may capture attention,<sup>181</sup> it is possible for the symptom experiences of older women with OA pain to be influenced by nature, which is most abundant in outdoor environments.

### **Pain of Osteoarthritis in Women: Environment Research Study**

This dissertation research is an initial inquiry into the phenomenon of OA pain experienced by older women in outdoor environments. The Pain of Osteoarthritis in Women: Environment Research (POWER) Study used a cross-sectional descriptive study design and a naturalistic approach to explore the influence of multi-sensory stimuli of nature on older women with OA pain. Data collection occurred in phases using distinct methods for each phase:

- **Preliminary Phase** – Retirement communities (RCs) were visited to identify and measure outdoor spaces using an objective tool. This information helped to guide selection of four RCs as study sites and identify two outdoor spaces at each RC study site for use in other phases of the study.
- **Phase 1** – Women with OA pain (N=16), residing at the four RC study sites, were interviewed about their outdoor experiences overall and in two outdoor spaces within their RC.
- **Phase 2** – Women (with and without OA; N=276), residing at the four RC study sites, completed an anonymous survey that included questions about time spent in two outdoor spaces within their RC.

## Conceptual Framework

Symptom Management Theory (SMT) provided the conceptual framework for the POWER Study.<sup>6, 27, 28</sup> SMT is a well-established theory that predicts dynamic bi-directional relationships among the domains of health, person, and environment.<sup>29-32</sup> Developed based on many years of symptom research by scientists in nursing at the University of California San Francisco, SMT guided all aspects of the POWER Study. Throughout this dissertation, constructs and concepts from SMT are italicized.<sup>1</sup> There are six major constructs in SMT: the domains of nursing science (*Health, Person, and Environment*) and the dimensions of the symptom management process (*Symptom Experience, Symptom Management Strategies, and Symptom Status and Outcomes*).<sup>2</sup> All major constructs of SMT were included in this dissertation and incorporated as described below into the chapters and elements of the POWER Study.

Chapter 2 of the dissertation describes SMT and reviews the literature regarding the domains of *Health, Person, and Environment* in relation to the POWER Study. Chapter 3 provides a focused review of literature on the influence of nature on health to explore current understanding of the use of nature as a *Symptom Management Strategy*. Chapter 4 reports on the Preliminary Phase of the POWER Study which measured the *Environment: Physical* (one component of *Environment*). This chapter describes the methods, data collection, and findings regarding the amount and type of nature in specific outdoor spaces of the selected RC study sites. Chapter 5 presents the *Symptom Experience* of older women with OA pain in outdoor

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<sup>1</sup> Throughout this dissertation the constructs and concepts of SMT will appear in *italics* to identify their specialized meaning, as defined by the developers of SMT.<sup>6,27,28</sup> To indicate that a concept is within a construct, the format will be *Construct: Concept*. When SMT constructs or concepts are not italicized, then they are being used to connote the generally accepted word meaning and not the specialized SMT word definition.

<sup>2</sup> The construct *Symptom Status and Outcomes* is a shortened version of the construct titled: *Symptom Management Outcomes and Symptom Status*.

environments. This chapter reports on the methods, data collection, and findings for Phase 1 of the POWER Study. Chapter 6 describes relationships among *Symptom Status and Outcomes* and *Person* factors in regard to the amount of time older women with OA spend outdoors. This chapter reports on the methods, data collection, and findings for Phase 2 of the POWER Study. Chapter 7 presents a situation-specific model, derived from SMT, that identifies the relationships among SMT constructs and concepts as derived from the POWER Study findings. Chapter 7 also presents the overall conclusions of the POWER Study regarding the potential for environment-based outdoor *Symptom Management Strategies* for older women with OA pain.

### **Purpose and Aims**

The purpose of this study was to explore symptom experiences of older women with OA when outdoors, as a foundation for future research regarding the influence of multi-sensory nature on the persistent pain of OA in older women. The specific aims were to:

- Aim 1:** Describe pain symptom experiences of older women with OA in outdoor environments.
- Aim 2:** Compare and contrast women's descriptions of their outdoor symptom experience related to two retirement community spaces that vary in the level of multi-sensory nature stimuli.
- Aim 3:** Describe the extent to which level of multi-sensory nature in outdoor spaces that women enter and person factors (OA, bodily pain, and functional status) are associated with time spent outdoors.
- Aim 4:** Integrate qualitative and quantitative findings based on Symptom Management Theory, to develop a situation-specific model of an environment-based pain management strategy for older women with OA.

**Table 1.1. Summary of POWER Study Design**

<b>Aims</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Methodology</b>	Qualitative		Quantitative	Qualitative and Quantitative
<b>Data Collection</b>	In-depth Interviews		Anonymous Survey	Interviews and Survey
<b>Sample</b>	16 women with OA		276 women with and without OA	Combined
<b>Analysis</b>	Content Analysis		Statistical Analysis	Integration
<b>Dissertation Chapter</b>	Chapter 5		Chapter 6	Chapter 7

### **Implications**

The achievement of these study aims will advance knowledge that is foundational for designing research on environment-based management strategies for reducing OA pain. Linking the study results directly to the concepts of SMT will guide the development of hypotheses for testing mechanisms of intervention effects. Although study findings pertain specifically to women living within RCs, this research holds promise for informing ways to help individuals self-manage OA pain. This research may ultimately contribute to the development of cost-effective, environment-based, interventions for groups of older adults living in congregate senior housing settings. Furthermore, the findings from this study may have implications for the design and use of outdoor spaces that provide contact with nature in health care settings ranging from acute to long-term care.

## Chapter 2

### REVIEW OF LITERATURE

This chapter begins with a description of Symptom Management Theory (SMT),<sup>28</sup> the conceptual framework that guided the Pain of Osteoarthritis in Women: Environment Research (POWER) Study. Building on this framework, there are three sections organized by the SMT domains of nursing science: *Health, Person, and Environment*.<sup>6</sup> The section on health reviews the physiology of pain and pain mechanisms in osteoarthritis (OA), followed by current pain management strategies for OA. The next section reviews person factors that may influence pain experiences in outdoor environments. The third section presents different aspects of the environment that may influence pain experiences. The chapter concludes with an explanation of how SMT supports the specific aims and methods of this study.

#### Conceptual Framework: Symptom Management Theory

Symptom Management Theory (SMT) was selected as the conceptual framework for this research on pain and multi-sensory nature because it is a well-established theory and includes all elements of the environment (*Physical, Social, and Cultural*).<sup>6,33</sup> Created as a means to test the effectiveness of interventions used by patients or health care providers, SMT is applicable to either acute or chronic symptoms<sup>28</sup> and is congruent with different research methodologies.<sup>32,34</sup> The roots of SMT are most closely linked to the Self-Care Deficit Theory of Nursing developed by Orem.<sup>27,28,35</sup> Orem's definition of nursing was described by nursing theory expert Meleis as "self-care agency to meet individual's need for self-care action in order to sustain life and health, recover from disease or injury, and cope with the effects" (p. 113).<sup>36</sup> The underlying ontological approach of Orem's theory is considered to be moderate realism;<sup>37</sup> a post-positivist approach whereby a theory is considered to be probably true, but not an absolute truth.<sup>38</sup> In contrast to

Orem's theory (which does not have a strong emphasis on environment), SMT emphasizes environment and the relationships among health, person, and environment.

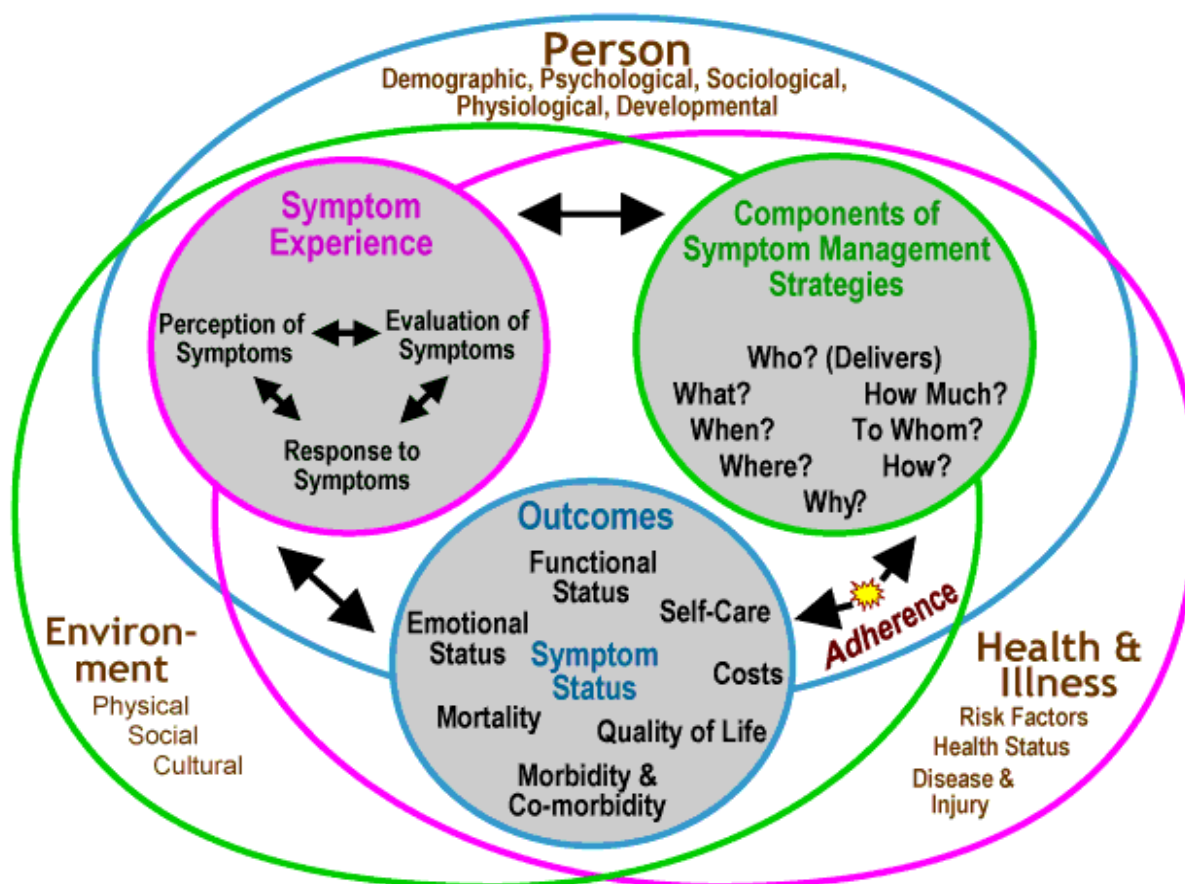
SMT was first published as the Symptom Management Model (SMM) in 1994 by a team of nursing scientists.<sup>27</sup> The SMM was based on research (conducted by these scientists) on symptom management in an effort to build a comprehensive model of factors influencing the different dimensions of the symptom management process: *Symptom Experience*, *Symptom Status and Outcomes*, and *Symptom Management Strategies*. The model was revised in 2001 with the explicit inclusion of nursing domains (*Health, Person, and Environment*) and the concept of *Adherence*.<sup>6</sup> In 2008 the SMM was re-introduced as a middle range theory, SMT, because studies using the model provided evidence for dynamic bi-directional relationships among the three dimensions and three domains.<sup>28</sup> This theory provides a framework for developing interventions for symptoms or sets of interrelated symptoms (symptom clusters). A situation-specific model may be derived from SMT by identifying factors predicted to influence the outcomes of an intervention for a population, condition, and symptom .

### **Constructs and Concepts**

There are six constructs in SMT, each comprised of multiple concepts. The constructs are the three domains of nursing science and three dimensions of the symptom management process. The SMT diagram in Figure 2.1 represents these constructs as ovals and circles.<sup>6</sup> Within each construct are specific concepts. All SMT constructs are predicted to have bi-directional relationships, although only the symptom management process constructs have bi-directional arrows in the diagram. The nursing domain constructs (*Health, Person, and Environment*) are considered to be contextual.<sup>6</sup> Selection of specific factors from each domain for use in a study depends upon the study's target population, symptom(s), and intervention. The symptom

management process is comprised of three dimensions (*Symptom Experience*, *Symptom Management Strategies*, and *Symptom Status and Outcomes*). The specific research question for a study guides the selection of concepts (within one or more of the dimensions). The concept *Adherence* is a factor that affects the relationship between the *Symptom Management Strategies* and the *Symptom Status and Outcomes* as shown in the SMT diagram. Although *Adherence* may be influenced by each of the SMT constructs (domains and dimensions),<sup>28</sup> it is specifically a measure of the extent to which an intervention is received by a patient.<sup>6</sup>

**Figure 2.1. Symptom Management Model<sup>6</sup>**



**Note.** This diagram is the graphic representation of Symptom Management Theory.<sup>28</sup> Copyright (2001) Wiley. Used with permission from Dodd M, Janson S, Facione N, et al. Advancing the science of symptom management. *Journal of Advanced Nursing*, March 2001.

Concepts encompassed by the SMT domains (i.e., *Health, Person, and Environment*) are discussed in the following sections of this chapter. *Adherence* is not addressed in this review because the POWER Study did not measure use of an intervention. Concepts within the dimensions of the symptom management process are elaborated below and then discussed further in the chapters that follow.

The construct of *Symptom Experience* includes three concepts: *Perception, Evaluation, and Response*.<sup>6</sup> These experiences have been described as occurring simultaneously<sup>28</sup> or over a short period of time. *Perception* is a person's report of a sensation. *Evaluation* is the person's appraisal of this sensation. *Response* is the person's reaction to the sensation and might be an emotion (e.g., distress), an action (e.g., removing a sweater because one is hot), or a physiological change (e.g., increase in heart rate).<sup>28</sup> *Response* refers to an immediate reaction, which is differentiated from the planned actions of a symptom management strategy.

The *Symptom Management Strategies* construct includes the "efforts to avert, delay, or minimize the symptom experience" (p. 147).<sup>28</sup> Although the term "intervention" is not used in the *Symptom Management Strategy* construct,<sup>6</sup> when a strategy is identified and defined for purposes of research (or clinical practice) it may be referred to as an intervention. The intervention can range from a single action taken by a patient (e.g., taking a medication, keeping a fan nearby to fan oneself if needed) to a complex intervention designed and implemented by a health care provider. The scientific rationale for an intervention is strengthened by knowledge of how it decreases the frequency or intensity of a symptom (i.e., its mechanism of action, represented by the concept *Why?*). The integrity of an intervention<sup>39</sup> is crucial to the evaluation of symptom management strategies; therefore, all of the concepts in the construct of *Symptom*

*Management Strategies* are essential, including the dose (*How much?*) and characteristics of intervention delivery (i.e., *Who delivers? To whom? What? How? Where? and When?*).

*Symptom Status and Outcomes* is a construct that includes both the person's report of symptom changes (e.g., frequency and intensity) and other symptom-related outcomes. Symptom-related outcomes, for example, *Functional status* and *Emotional status* are predicted to improve with decreased symptom perception.<sup>28</sup> *Quality of life*, including a person's sense of well-being, is recognized as being of particular importance to persons experiencing persistent pain from chronic conditions.<sup>40</sup> *Self-care* (called *Self-care Abilities* in the first publication of the model)<sup>27</sup> refers to an individual's level of independence. *Mortality*, as an outcome of *Symptom Experience* demonstrates that SMT includes the most critical impact of severe symptoms. The outcome of *Morbidity* (and co-morbidities) is the connection between a symptom and underlying disease process(s) contributing to change in the *Symptom Experience: Perception*.<sup>27</sup> Finally, inclusion of *Cost* as an outcome acknowledges the impact of symptoms on more than just a person's health (e.g., financial impact).<sup>28</sup>

### **Assumptions**

Assumptions identified by the SMT developers are:<sup>6</sup>

- The patient's perception of the symptom defines the experience of the symptom.
- If a symptom is distressing to the patient, then it needs to be managed.
- A proxy (family or provider) may provide the report of a symptom, through interpretation of behavior, for someone unable to communicate.
- Symptom management includes preventing symptoms for those at risk.
- A management strategy may involve any aspect of person or environment.

- Symptom management is a process, modified by outcomes and influenced by person, health, and environment.

Three additional assumptions can be inferred from the literature describing SMT:

- The patient's experience is central to symptom management.<sup>27</sup>
- Symptom management strategies are conceptualized as distinct from symptom responses (responses being a part of the *Symptom Experience*).<sup>6</sup>
- The symptom experience may occur without physiological signs of pathology.<sup>27</sup> Symptoms may be experienced even after the pathology has resolved (e.g., phantom limb pain).<sup>41</sup> Symptoms may also be related to a normal physiological process (e.g., menopause).<sup>42</sup>

Several of these assumptions are of particular importance for building evidence to develop and test an intervention for symptoms. An individual's perception defines the symptom experience and this experience is central to the symptom management process. Therefore, it is crucial to begin investigating an intervention with a clear understanding of the *Symptom Experience* as described by members of the target population.

Additionally, some SMT assumptions are especially relevant regarding interventions for persistent pain from a chronic condition. First, chronic conditions involving pain often include variation in the amount of pain from day to day,<sup>43</sup> therefore an intervention can contribute to prevention, in addition to reduction in the frequency or intensity, of pain symptoms. Second, a person with a chronic condition may experience greater pain than what is suggested by physiological signs of the disease pathology.<sup>41</sup> Both of these underlying assumptions are congruent with symptom management strategies for persistent pain that may continue over a long period of time and that may show little or no sign of pathology. Finally, the assumption that

the symptom management process can be influenced by the physical environment sets this theory apart from other pain management theories.<sup>33</sup> Thus, SMT supports investigating an intervention for OA pain that involves the design and use of the built environment.

### ***Health***

The SMT *Health* construct directs attention to the pathology leading to a person's symptom experience. Understanding the physiological mechanisms related to experiencing a particular symptom is central to the search for interventions to reduce symptom frequency or intensity. OA, a disease characterized by persistent (often daily) pain, is the health condition of interest in this study. The pathophysiology of pain in general and then OA pain in particular are presented first. This information is followed by a review of pain management strategies for OA. The *Health* section concludes with a review of research on distraction as a pain management strategy.

### **Osteoarthritis Pain**

An overview of pain in general provides a foundation for understanding OA-specific pain. Pain is a perception and described as an unpleasant experience.<sup>44</sup> Pain is related to nociception, which is the transmission of signals by specialized nerve cells (nociceptors) that relay information about peripheral tissue injury.<sup>45, 46</sup> In many chronic conditions associated with persistent pain, including OA, the pain symptom experiences individuals report are not congruent with the severity of tissue injury.<sup>1, 43, 47</sup> Strategies for OA pain management, therefore, include reducing nociception (from tissue injury) and altering pain perception through behavioral and psychological approaches.<sup>8, 48-50</sup>

**Pain physiology.** Current theories of pain are consistent with gate control theory (GCT),<sup>45</sup> but also emphasize the role of cognitive modulation and other central processes

involving multiple brain regions.<sup>41, 51</sup> The perception of pain arises from both nociception and supraspinal processing by the central nervous system (CNS).<sup>51</sup> Central sensitization (based on neurochemical and neuroanatomical changes in the CNS)<sup>52</sup> contributes to the highly individualized perceptions and responses to pain.<sup>43, 51, 52</sup> Central sensitization is now recognized as a contributor to the symptom experience of OA pain.<sup>53, 54</sup>

According to GCT, a stimulus from actual or perceived tissue damage in the periphery is communicated to the CNS via a nociceptor.<sup>45</sup> Both A $\delta$  (fast) and C (slow) nociceptors transmit neurochemical signals in response to this peripheral stimulation.<sup>45</sup> At the nociceptor terminal (synapse in the dorsal horn of the spine) this transmission may be modulated by another nerve cell (non-nociceptor, A $\beta$ ).<sup>55</sup> At this site (the "gate" in GCT), and along ascending and descending neurons in the spinal column, transmission of somatosensory information is inhibited or facilitated via neurochemicals (e.g., endogenous opioids, gabapentin, dopamine, serotonin). The neurons connect with multiple brain regions that pain researchers now refer to as the pain matrix.<sup>56</sup> The pain matrix is considered to include the brain stem, thalamus, amygdala, periaqueductal gray (PAG), and cortical regions (primary and secondary somatosensory, prefrontal, insula, and anterior cingulate).<sup>46, 57</sup> Persons with chronic conditions associated with pain show some evidence of greater activity in the thalamus and PAG; increased activity in the insular region was found to be associated specifically with knee OA.<sup>46</sup>

In summary, persistent pain from a chronic condition is associated with neuroanatomical and neurochemical changes that lead to increased pain from sensitization. Sensitization has both peripheral and central components.<sup>52</sup> Peripherally, nociceptors respond to a mild painful stimulus as though it were more severe.<sup>7</sup> Centrally, within the spine and pain matrix of the brain, sensitization involves changes, such as an increase in the neurotransmitter glutamate.<sup>41</sup> Central

sensitization helps to explain how pain can be experienced without nociception; it is currently under consideration as an explanation for some chronic pain conditions (e.g., fibromyalgia).<sup>9, 51</sup> Central and peripheral sensitization contribute to responses that are perceived as uniquely individual pain experiences.

**Osteoarthritis-specific pain.** Development and testing of symptom management strategies for OA depend upon an understanding of the physiology of pain and sources of pain related to OA.<sup>43, 50</sup> OA is a chronic degenerative joint disease characterized by pain and stiffness in joints, most commonly the hand, knee, hip, or spine.<sup>1</sup> OA progresses over time from a mild decrease in joint function and mild pain to a severe decrease in function and severe pain.<sup>49</sup> There are multiple sources of tissue injury in OA that cause pain. Connective tissue degeneration (i.e., cartilage at the end of the bone), osteophytes, and inflammation of the joint are mechanical factors that stimulate nociceptors.<sup>43</sup> Weak muscles may also contribute to pain through joint misalignment.<sup>58-60</sup> Obesity, a contributing factor to knee and hip OA through increased pressure on joints,<sup>61</sup> may also have a more direct relationship with OA pain through alterations in metabolism.<sup>62, 63</sup> These multi-factorial sources of OA pain, in addition to sensitization related to persistent pain,<sup>54</sup> help to explain the incongruence between radiological evidence of OA severity and pain level.<sup>1, 43, 64</sup> The above processes influence a person's perception of pain, leading to an individual's symptom experiences of OA pain.

Qualitative research on pain symptom experiences associated with OA pain is limited but important because of the insights gained regarding individual responses to pain.<sup>65, 66</sup> Hawker and colleagues<sup>67</sup> conducted a study involving focus groups and individual interviews with 143 participants with OA. Content analysis was used to examine the words participants used to describe OA pain. Depending on the stage of OA (early to advanced), differences were noted in

the characteristics of pain described by participants. Additionally, there were distinct behavioral responses to different types of pain (e.g., constant dull pain versus intense sharp pain).

Participants used many different words to describe their pain. The use of words related to neuropathic pain ("burning, pins and needles")<sup>67</sup> indicated to the study report authors that central sensitization is a component of the OA pain experience described by the participants.

In another study,<sup>68</sup> of five women (72 years and older) with OA, Baird used a phenomenological approach to identify several themes unified by the overarching concept of Holding On. One theme, "holding on by purposefully choosing and acting",<sup>68</sup> is helpful in understanding choices related to self-care and arthritis self-management strategies. Baird's study and the study by Hawker and colleagues exemplify the value of qualitative research to improve understanding of OA pain symptom experiences. This type of knowledge can contribute to developing interventions designed to decrease OA pain.

Improving OA pain management is crucial for decreasing disability. Decreased OA pain encourages increased activity that in turn improves function, and further decreases pain.<sup>69, 70</sup> The daily pain of OA is a chronic stress that contributes to adverse physiological (e.g., increased cortisol)<sup>71</sup> and psychological (e.g., depression)<sup>72</sup> consequences. Self-management strategies are essential to improve care of older adults with OA; investigation into specific elements of these strategies can increase understanding of what contributes to the effectiveness of the intervention.

### **Osteoarthritis Pain Management Strategies**

Specific OA pain management strategies are a major component of the self-care that is taught to patients through their health care providers, written patient education materials, and planned intervention programs.<sup>69, 73</sup> Medication, along with exercise, assistive devices to support joints, and weight reduction are standard components of this patient self-management education.

1, 50, 74 There are conflicting findings from meta-analyses regarding the effectiveness of arthritis management interventions.<sup>75-77</sup> OA interventions that may decrease pain and improve function (or slow the progression of the condition) need to be studied over longer periods of time (years rather than months).<sup>78</sup> Furthermore, given the high cost of care for individuals with OA (estimated at \$5,700 per year)<sup>79</sup> and projections of increasing prevalence of OA in the coming years,<sup>80</sup> it is important to continue investigating both overall intervention strategies, as well as specific intervention components.

**Self-management strategies.** OA self-management interventions include programs that range from education booklets, to multi-week therapeutic programs, to ongoing exercise classes.<sup>50, 77, 81</sup> Comparison of different interventions is complex even though self-management interventions often include similar components. Furthermore, efficacy and effectiveness testing of interventions may be conducted with samples that include patient populations with persistent musculoskeletal pain from different conditions. For example, individuals with OA, rheumatoid arthritis,<sup>77</sup> or without a specified diagnosis<sup>82</sup> may be in the sample for which the intervention is being tested. There are variations in delivery methods, timing, and duration that may influence the effectiveness of interventions.<sup>39</sup> Details of these interventions are essential for evaluation and dissemination, and are provided by many authors,<sup>50, 77, 81, 83, 84</sup> but some meta-analyses do not include such details.<sup>76</sup> Some self-management interventions, though not all, do include medication, exercise, and psychological or behavioral (e.g., mind-body) components.

Pharmacological approaches to OA include a range of medications used to treat chronic conditions associated with persistent pain. Acetaminophen is currently recommended as the first medication to consider for musculoskeletal pain in older adults (unless the individual has contraindications for its use).<sup>8</sup> Non-opioid analgesics, including acetaminophen and non-

steroidal anti-inflammatory drugs (NSAIDs), are effective in controlling pain for some individuals with OA, but are insufficient for other individuals.<sup>85, 86</sup> In addition, the long-term use of these analgesics by older adults needs careful monitoring for potential adverse side effects, as these medications will often be used for years.<sup>8</sup> If non-opioid analgesics are not sufficient, then other adjunctive medications, including anti-depressants may be added.<sup>49, 87</sup> Opioids, which are increasing in use for non-cancer chronic pain conditions, can be used for OA, but also warrant caution and attention to side effects.<sup>88</sup>

The improvement of OA through exercise has been studied extensively, with findings of reduced pain and improved function.<sup>76, 77, 89</sup> Exercise increases muscle strength which improves joint alignment and thereby decreases pain.<sup>60</sup> There is preliminary evidence that exercise increases interleukin-10 (which has an anti-inflammatory effect) within the knee joints of women with knee OA.<sup>90</sup> Exercise also supports weight reduction, which decreases strain on joints and thereby decreases tissue injury. Exercise (and physical activity, more broadly) is, therefore, an essential component of OA self-management.

**Mind-body therapies.** Mind-body therapies are currently used to support self-management of persistent pain from OA and other chronic health conditions.<sup>91, 92</sup> There are many different therapies used, including both specific activities (e.g., yoga, hypnosis, progressive muscle relaxation, meditation)<sup>91, 93</sup> and more complex training in pain coping skills delivered by psychologists (e.g., cognitive-behavioral therapy, acceptance therapy).<sup>92</sup> Many of these strategies are related to distraction (focusing attention away from pain), relaxation (to decrease stress), or both.<sup>92</sup>

Mind-body strategies may reduce OA pain and thereby reduce chronic stress<sup>94</sup> or increase relaxation (to decrease the stress response)<sup>95</sup> that in turn reduces pain. These strategies can

decrease the biopsychosocial stress responses that may be harmful to health in general.<sup>96</sup> The relationship between stress and health has been well established in Selye's model of adaptation to both biological and psychological threats.<sup>97</sup> Stress reduction can be measured physiologically, for example, through blood pressure, heart rate, and biomarkers such as cortisol.<sup>94,98</sup> These physiological indicators change based on the effect of stress on the hypothalamic-pituitary-adrenal axis (HPA). The field of psychoneuroimmunology is increasing knowledge about the relationship between the immune system and stress.<sup>95</sup> A meta-analysis found that psychological stress delays wound healing ( $p < .01$ ).<sup>96</sup> These findings have direct implications for OA, where the balance between damage and repair in a joint is crucial and the contribution of inflammation to pain is well established.<sup>43</sup> Therefore, a mind-body therapy that decreases stress may also decrease OA pain.

### **Distraction**

Distraction is a psychological mechanism that is frequently used to decrease the impact of the pain symptom experience and has an immediate effect on the perception of pain. The brain has multiple redundant systems for pain sensing that have priority for one's attention over other sensory experiences.<sup>99</sup> Although "pain demands attention,"<sup>100</sup> there are multiple ways to divert attention away from pain.

The term distraction is used by pain researchers in reference to two different methods of redirecting attention away from pain: cognitive tasks<sup>101-103</sup> and sensory distraction.<sup>104</sup> Cognitive distraction requires intentional effort (e.g., doing mathematical calculations). Sensory distraction, which does not require effort, was identified by Fernandez and Turk (1989) as a distinct category of pain coping (external focus of attention) that refers specifically to the redirection of attention by the presence of sensory stimuli.<sup>105</sup> These authors determined that

external focus of attention (i.e., sensory distraction) had a moderate effect (weighted mean  $d = 0.49$ ), based on a meta-analysis of 14 studies that involved different types of pain.

Sensory distraction through the use of multi-sensory stimuli is receiving increased attention as a method for reducing acute pain in hospital and clinic settings.<sup>26, 106-109</sup> However, there has been limited study of sensory distraction as a method for reducing OA pain. In a study of arthritis pain management (in a convenience sample recruited from three retirement communities,  $n=17$ ), participants reported that distraction was considered helpful in response to pain ( $p = .01$ ).<sup>110</sup> Another study, a naturalistic inquiry regarding self-care of older women with OA, found they used strategies that may be considered sensory distraction (diversion, gardening, and enjoying pets).<sup>111</sup> Additionally, control group participants in a randomized controlled trial ( $N=45$ ) of an intervention for older adults with chronic pain reported one of the most frequently used strategies was "...engaging in pleasurable activities to distract themselves from the pain..." (p. 163).<sup>112</sup> The effectiveness of sensory distraction for OA pain is essentially unknown, as are the circumstances regarding where, when, how, or why it is used by older adults with OA, .

Sensory distraction is hypothesized to decrease pain through inhibition of the descending spinal neurons, by engaging attention toward compelling stimuli and thereby decreasing attention to pain.<sup>113</sup> A study in an animal model of pain found that rats exposed to a novel object (a plastic tube placed in the cage) paid greater attention to the stimulus (i.e., a greater distraction from pain) than those exposed to a control condition ( $p < .05$ ).<sup>114</sup> Findings of a decrease in serotonin and dopamine in the medial frontal cortex of rats in the novel object condition led the investigators to contend that the observed decrease of these neurochemicals was related to a decreased pain response (i.e., descending inhibition). This study is the first attempt to demonstrate, through an animal model, objective evidence supporting the mechanism of

descending inhibition of pain via environmental sensory distraction. The findings support the need for additional clinical research in humans, particularly those with OA, to demonstrate the extent to which sensory distraction can reduce the pain experienced.<sup>115-119 120, 121 122, 123</sup>

Attentional strategies (imagery, meditation, hypnosis, and others) that are used in therapeutic approaches for persistent pain involve some intentional cognition by the patient. Distraction via sensory stimuli, however, is a process that typically does not involve effort or intention by the patient. Sensory distraction has been tested with a wide variety of stimulus sources (e.g., nature, car racing)<sup>124</sup> and various combinations of different types of stimuli (e.g., visual and auditory).<sup>125</sup> Sources of sensory stimuli are presumed to affect the level of distraction based on individual preferences for different stimuli; however, this assumption needs further testing. There is limited, but compelling, evidence that suggests multi-sensory stimuli are more distracting than single stimuli,<sup>26, 107, 119, 124</sup> but more research is needed to determine whether specific sources or certain combinations are more effective than others in distracting from pain. An ongoing five-year study<sup>119</sup> (based on ten years of prior research) of children distracted by their parents (e.g., talking, blowing soap bubbles) is the most in-depth study of sensory distraction found to date. The study included measurement of salivary cortisol<sup>118</sup> and found that higher levels of distraction provided by parents was associated with decreased cortisol in children experiencing acute procedural pain.<sup>109</sup>

Nature is frequently identified as a source for distracting and relaxing stimuli, based on the high degree of preference for nature over other visual scenery<sup>126</sup> and as evidenced by the traditional gardens designed as places of restoration found in cultures through the world.<sup>127</sup> Real nature (versus pictures of nature often used in research) provides meaningful combinations of sensory stimuli, which may be highly engaging and provocative of memories.<sup>128</sup> Nature may,

thereby, effectively divert attention away from pain. Randomized controlled trials of acute pain in clinical settings have tested the effectiveness of using nature-related stimuli as sensory distraction compared to a condition with no distracting stimuli. It is important to note that these studies used sensory and not cognitive distraction, as patients were given no instructions, such as to focus or concentrate.<sup>26</sup> For example, in one study comparing a single sensory stimulus to a combination of two stimuli, male sigmoidoscopy patients (N=37) experienced lower pain (lower scores on a visual analog scale) with ocean scenery and sounds (audiovisual 7.1), compared to audio alone (9.5) or no distraction (10.8).<sup>129</sup> Although there is research indicating that contact with nature reduces pain (window view of trees,<sup>130</sup> potted plants in hospital room<sup>131</sup>), studies have not directly examined whether spending time within garden environments facilitates distraction from persistent pain associated with chronic conditions.

Sensory distraction as a means of reducing pain specifically in older adults with OA is potentially an effective mind-body strategy, and nature in outdoor environments might be an accessible source of engaging multi-sensory stimuli. Although promising, studying distraction in outdoor environments poses several methodological challenges: 1) the influence of person factors, 2) identifying and measuring environment factors, 3) clarifying the concept of "contact with nature," and 4) identifying an appropriate conceptual framework. These challenges will be addressed in this and subsequent chapters.

### *Person*

Person factors that may influence responses to pain include demographic, physiological, psychological, sociological (i.e., biopsychosocial), and developmental characteristics.<sup>6</sup> Person factors may influence the capacity to direct attention, which then determines whether an engaging stimulus captures attention and distracts from pain. Additionally, as one focuses on sensory stimuli present in the outdoor environment, person-environment relation is an important factor but difficult to measure. Initial investigation in this area of research is needed to identify and either control or measure extraneous factors.

#### **Demographic**

**Age.** Because OA is strongly age-related, it is important to examine sensory distraction from OA pain in adults ages 65 and older. Aging involves physiological changes that affect the sensory systems (including pain), most notably declines in vision and hearing. Changes with aging affect both peripheral nerves (including decreased number and size) and the central nervous system (including the brain regions of the pain matrix).<sup>132</sup> In addition, there are changes in the metabolism of medications, related to decreased kidney and liver function, which can impact the effectiveness of pain medication and increase the risk of side effects.<sup>8</sup> Therefore, nondrug strategies for persistent pain are especially important for older adults, although they have primarily been tested in younger populations.<sup>133</sup> Increasingly, older adults are being included in the evaluation of patient education programs and cognitive-behavioral therapies for persistent pain, including OA pain.<sup>82, 134, 135</sup>

**Gender.** There is a higher prevalence of most chronic pain conditions, including OA, in women compared to men.<sup>3, 136</sup> The potential reasons for this higher prevalence include increased pain sensitivity (lower threshold), hormone exposure (estrogen), and lower descending

inhibition of pain.<sup>4</sup> In addition, older women, because of a longer life span and inequity in pay rates, are more likely to experience poverty<sup>137</sup> and concomitant high levels of stress. There is a greater risk of polypharmacy<sup>5</sup> (from more medications taken over a longer time), and therefore a potential avoidance of pain medications to decrease side effects. All of these factors highlight the need for research on nondrug pain management strategies that are effective for older women.

**Race/ethnicity.** OA occurs frequently in older adults of all races and ethnicities, with some studies showing higher rates in African Americans.<sup>1</sup> There is an indication of racial/ethnic differences in response to pain, but these differences are very complex.<sup>138, 139</sup> Therefore, it is important to recruit racially and ethnically diverse samples when studying pain in older women.

### **Biopsychosocial**

**Sensory.** Because the therapeutic effect of nature is based on sensory stimuli, assessing the status of a person's sensory system is essential. Older adults have declines most notably in vision and hearing, but also in tactile, olfactory, and gustatory sensations.<sup>140-142</sup> Vision, hearing, and olfaction are most easily measured (either by self-report or by objective evaluation) and should be included, when possible, in descriptions of study participants.

**Functional ability.** There is a strong association between pain and function in OA, making the measurement of functional status key in understanding the effects of pain therapeutics.<sup>112</sup> There is even suggestion in the literature that measurement of function as an outcome may be as important as pain.<sup>40</sup> For persons with OA functional ability is improved by physical activity; consequently there is extensive research on physical activity and OA.<sup>89</sup> Given an increased interest in the association between the built environment and physical activity, the relationship between the built environment and OA is also under consideration.<sup>143, 144</sup>

**Co-morbidities.** Co-morbidities, including chronic pain conditions, cognitive impairment,<sup>145</sup> affective disorders (depression and anxiety),<sup>146</sup> and sleep disorders are key factors that potentially influence responses to distracting stimuli. It is particularly important to identify whether participants have other chronic pain conditions, such as rheumatoid arthritis and fibromyalgia that involve joint pain distinct from the pain of OA and different treatment approaches.<sup>89</sup> In studies of OA pain the measurement or control (through exclusion) of these co-morbidities is needed as they may influence responses to pain management strategies.<sup>82</sup> In addition, co-morbidities that limit mobility and activity are particularly important as they may contribute to pain by decreasing one's tendency to engage in physical activity.

### **Developmental**

Studying person-environment relations (e.g., how older women respond to nature in outdoor environments) involves a consideration of social-ecological models of human development.<sup>147</sup> Methodological approaches to studying person-environment relations have perhaps been most thoroughly examined in environmental psychology. This discipline uses a transactional epistemology, where person-environment is the unit of analysis, an inseparable whole that loses meaning when the parts are considered separately.<sup>148</sup> Scientists who study the influence of environment on health handle this challenge by acknowledging the constraints of scientific inquiry and the need for two units of analysis (i.e., the person and the environment).<sup>149,</sup><sup>150</sup> The methodological issues when studying the person-environment relation include multiple levels of environment (e.g., physical, social, and cultural), subjective (as well as objective) measures of the environment, and the dimension of time.<sup>147, 149</sup>

Older adults have leisure activity preferences related to being outdoors (or indoors) that are often long-term and extend back to childhood.<sup>151</sup> Past, as well as current, preferences are

relevant, because an older adult who currently prefers to stay indoors (perhaps because of a fear of falling)<sup>152</sup> may nonetheless have had an earlier preference for outdoor environments with nature. These preferences may be associated with leisure activities including gardening, hiking in the mountains, or going on vacations to settings with exceptionally beautiful natural environments, particularly settings that include water.<sup>127, 153</sup> Contact with nature is an important, some consider essential,<sup>126</sup> element contributing to quality of life.<sup>154, 155</sup> Thus, "contact with nature" has additional importance as a potential pain management strategy for older adults with OA pain, as quality of life<sup>156</sup> is an outcome valued by persons with persistent pain.<sup>40</sup>

### ***Environment***

Environment is a multilayered concept that includes physical, social, and cultural elements. Social-ecological models include all of these elements as essential in understanding person-environment relations.<sup>149</sup> This section will begin with a brief discussion of the social and cultural elements of environment in relation to health. The major focus of this section will be on the physical environment. Review of the research on contact with nature (part of the physical environment) and health is in Chapter 3.

### **Social**

The social environment encompasses the interpersonal relationships that can support and influence the health of an individual.<sup>6</sup> In research on chronic pain conditions, social support has been identified as contributing to the success of self-management interventions.<sup>83, 157</sup> The social environment of older adults may be complex and changing. Decreased mobility can lead to increased dependence on family members; death of a spouse may lead to changes in other social relationships. Moving to a senior congregate housing setting (such as a retirement community;

RC) changes a person's social environment and brings closer contact with many new people, but also a loss of the social life experienced in the prior residence.

## **Cultural**

The cultural environment includes a wide range of influences, from formal to informal groups and the socioeconomic conditions of a person's neighborhood, which can impact an individual's health.<sup>6, 158, 159</sup> These components of the environment are also referred to as social determinants of health.<sup>158</sup> Government and civic organizations in the area where a person resides, in addition to ethnic, religious, and work-related group associations, may contribute to health. RCs and other senior congregate settings usually have policies and programs that have been developed to provide a safe and healthy environment.<sup>160</sup> The scheduled programs of a RC can encourage (or discourage) use of the outdoor environment.<sup>161</sup> For example, RC policy that allows pets will enable a resident to own a dog, and having a dog is associated with increased walking outdoors.<sup>162, 163</sup>

## **Physical**

The physical environment is recognized as an important determinant of health.<sup>164, 165</sup> The removal of environmental hazards in the form of infectious or chemical agents and conditions that pose a risk for injury has been the primary focus of research on the influence of physical environments on health.<sup>166, 167</sup> The built environment refers to physical features of the environment that have been built or altered by humans. Features of the built environment that may help to maintain and/or improve health are now a focus of intense research.<sup>11, 12</sup> Studies of the potential impact of outdoor built environments on health conditions have addressed obesity,<sup>15</sup> depression,<sup>14</sup> and chronic illnesses.<sup>143, 144</sup>

The built environment is recognized as a means of delivering health-promoting interventions to a community by supporting positive changes in behavior.<sup>11</sup> "Modifying the physical, social, or legal/regulatory environment in which people live can sometimes be more expedient and reach more people than attempting to induce voluntary behavior change on a mass scale" (p. 178).<sup>168</sup> For example to increase opportunities for physical activity, and subsequent health benefits, urban planners develop walking routes that coordinate with public transportation.<sup>169</sup>

Because of the potential for health interventions, there is increasing attention to the validity of tools that measure dimensions of the built environment.<sup>170</sup> The most common dimensions considered are those that support physical activity and include land use, traffic, aesthetics, and safety.<sup>12</sup> Older adults are particularly sensitive to attributes of the built environment.<sup>171, 172</sup> In fact, the design of environments to improve health for older adults has long been an area of research, with the recognition that the built environment makes an important contribution to the quality of life for vulnerable older adults.<sup>172, 173</sup> According to Lawton, important dimensions for older adults with chronic illness include safety, orientation, functionality, stimulation (aesthetics), personal control, and support of social interaction.<sup>173</sup> Measurement of built environments that include these dimensions will support the development and testing of environmentally-based interventions for older adults.

### **Application of SMT to Environment-based Research on Symptom Management**

Although it is possible to conduct research without theory, theory-guided research has greater potential for advancing knowledge.<sup>36</sup> Theory is particularly important for the analysis and interpretation of non-experimental study findings. Theory is also useful for addressing the challenges to scientific rigor that are inherent in a nondrug, environmentally-based strategy as a

component of a pain self-management intervention. These challenges, which relate primarily to experimental rather than descriptive studies, include the difficulty of conducting experiments where neither participants nor study staff can be masked to group assignment and the need to address many extraneous factors. The findings of the POWER Study, which is descriptive in design, will be used to develop hypotheses for testing in future research.

SMT is well-established and has continuing support by the National Institutes of Health for its further development and use.<sup>28</sup> In particular, the explicit identification of the physical environment as an antecedent in the symptom management process is a unique feature of this theory in comparison to other theories and models currently used in symptom management research.<sup>33</sup> The underlying assumptions and key concepts of SMT are congruent with current research on pain and the aims of this study. For example, the SMT assumption that a person's perception of a symptom defines the symptom experience is aligned with neuroimaging research on pain perception<sup>46</sup> and current pain assessment guidelines for older adults.<sup>174</sup> The SMT assumption that the symptom experience may occur without physiological signs of pathology is of particular importance in studying persistent pain from a chronic condition. This assumption is supported by the lack of congruence between radiological evidence of OA and the severity of pain reported,<sup>1</sup> as well as the role of central sensitization in the experience of pain related to OA.<sup>54</sup> Finally, the assumption that a management strategy may involve any aspect of person or environment is crucial to evaluating the influence of the physical environment on pain.

## **Conclusion**

SMT was used as a conceptual framework to guide the design of this study on OA pain in older women. Concept definitions and the dynamic bi-directional relationships among SMT constructs helped to refine the study aims. Importantly, SMT provided a theoretical framework supporting the use of both qualitative and quantitative methods. Therefore, the findings of the POWER Study will guide the development of hypotheses based on SMT. Ultimately, this work will provide a sound foundation for future research on the development and testing of interventions that address the influence of nature on pain in older women with OA.

### Chapter 3

#### "CONTACT WITH NATURE" AND HEALTH

This review of the research on contact with nature and health provides a foundation for investigating the influence of nature in outdoor environments on osteoarthritis (OA) pain in older women. The chapter begins with a discussion of two concepts relevant to the Pain of Osteoarthritis in Women: Environment Research (POWER) Study: "contact with nature" and "outdoor spaces entered." Studies on nature and health are then reviewed, with particular attention to studies that used nature-related stimuli to distract from pain. The chapter concludes with a discussion of how the POWER Study contributes to a knowledge base for future research on 'contact with nature' and OA pain in older adults. Ultimately, the POWER Study findings, through use of Symptom Management Theory (SMT)<sup>6</sup> will help to guide the development of the *Symptom Management Strategy* components regarding *Why, Where, How, and How Much*.

#### Contact with Nature

Nature is an aspect of the environment that is frequently included in descriptions of optimal healing environments.<sup>175</sup> Healing environments are described as both the physical and social surroundings that are in the immediate proximity of patients.<sup>176</sup> Although contact with nature is considered a component of these environments that contributes to healing, what is meant by the terms "contact" and "nature" is often unclear.

Nature is defined in the Oxford Dictionary as "the phenomena of the physical world collectively, including plants, animals, the landscape, and other features and products of the earth, as opposed to humans or human creation (definition 1)."<sup>177</sup> Meanings associated with the term nature range from one extreme of "the wild"<sup>178</sup> (to be completely away from humans and human habitation) to another extreme of a small plant growing in a container indoors.<sup>131</sup> In

research on the association of nature and health there are many attributes of physical environments considered to be nature including greenness,<sup>179, 180</sup> trees,<sup>130</sup> and pleasant scenery.<sup>125</sup> However, there is limited examination of the validity of these terms for describing environments containing nature of the type and quality that may influence health. Furthermore, many studies that examine the influence of nature on health use photographs or sound recordings<sup>104, 129</sup> that are only representations of nature.

The complex and variable qualities of nature, qualities that contribute to how nature may engage attention,<sup>181</sup> are found in what Frumkin termed "domains of nature contact."<sup>23</sup> These domains include animals, plants, landscapes, and wilderness. Implicit in these domains is a distinction among different places where nature is experienced. Contact with nature in the form of animals and plants may be experienced indoors. Landscapes may be experienced indoors (when viewed through a window), but are only fully experienced as places that one enters. Wilderness (i.e., to be away from human habitation) can only be experienced out of doors.<sup>178</sup> In addition, when a person is outdoors the weather becomes an important component that contributes to the experience of nature. Outdoor experiences provide a range of stimuli that are more varied and novel than indoor experiences because of weather (e.g., sun or rain, temperature variations, and the wind), seasonal changes in plants, and the presence of animals.

Contact with nature also includes the degree of closeness (proximity) to nature, the number and combination of senses that are stimulated (e.g., visual only versus visual, olfactory and tactile together), and whether interaction occurs between a person and nature. Three levels of contact with nature were presented by Hansen-Ketchum and colleagues: viewing nature, incidental contact, and active participation.<sup>166</sup> Viewing nature involves only the visual stimuli of nature or representations of nature (e.g., photographs). Incidental contact with nature may occur

indoors or out of doors, and includes nearby nature (such as living in a neighborhood with more trees) or walking close to nature (but not attending to the presence of nature). Active participation with nature involves intentional engagement with nature, which could include going outside to "take a deep breath of fresh air", bird watching, or gardening. These levels of experiencing nature combined with the domains suggested by Frumkin make clear the complexity of contact with nature and the need for specificity when conducting research studying the association between nature and health.

Three aspects of contact with nature that might be particularly relevant to research on persistent pain are:

- 1) The degree to which nature in a particular space provides multi-sensory stimulation (visual, auditory, olfactory, tactile, and gustatory)
- 2) The place where nature is experienced (particularly whether it is indoors or outdoors)
- 3) An individual's perception of the place where contact with nature is available

Nature is inherently multi-sensory; however, one cannot assume that nature in a built environment provides variation in sensory opportunities. Outdoor built environments are places designed by humans, in contrast to the natural environment that has not been altered by humans.<sup>12</sup> Nature in built environments may be present in a way that provides primarily visual stimuli.<sup>182</sup> However, an outdoor space can be designed to provide rich multi-sensory stimuli in the form of sounds, scents, and opportunities for touching or tasting nature. An individual's perception of a place is a dimension of the person-environment relation that is very complex.<sup>149</sup> Past experiences in a place contribute to positive or negative perceptions of the place.<sup>183</sup> Place attachment,<sup>184</sup> which is particularly important for older adults who have moved into a retirement community,<sup>185, 186</sup> may be influenced by the design of outdoor environments.<sup>185</sup> While the type

and level of multi-sensory stimuli and design features of an outdoor environment can be measured objectively through quantitative methods, the individual perception of place is subjective, and therefore better understood through use of qualitative methods.<sup>187</sup>

For the POWER Study, contact with nature was defined as the time spent in identified outdoor spaces that have been measured objectively regarding the availability of multi-sensory nature stimuli that are provided by design features. An "outdoor space entered" is a concept that indicates when a person is within a specific outdoor space, such as a courtyard garden. To enter an outdoor space an older adult must first go outdoors. The process of "going outdoors" was beyond the scope of the POWER Study (which was focused on time spent outdoors) but warrants careful examination.

The phenomenon of going outdoors is an emerging area of gerontological research as there is evidence that the frequency<sup>188</sup> and distance<sup>189</sup> an older adult goes away from home is associated with future health. Life space, the distance an older adult travels from home (beginning with the interior of the house and moving further outwards to outside the home, outside the neighborhood, etc.),<sup>190</sup> is a measure that has been used for studying this phenomenon. One study of older adults' life space after hospitalization described the activity of going outdoors as "boundary breaking", indicating the importance of going outdoors for quality of life.<sup>191</sup> "Just get out the door!" (p. 198)<sup>192</sup> is how another team of researchers summarized the contribution of going outdoors to the health of older adults. Although going outdoors has been associated with better health,<sup>193</sup> there is need for more research on the characteristics of outdoor environments where older adults actually spend time.<sup>194</sup> Research on the influence of different physical environments on the health of older adults is not new,<sup>150, 195</sup> therefore this recent research on distance traveled and time spent outdoors builds on prior work. The POWER Study contributes

to this body of research by exploring the *Symptom Experience* (as defined by SMT) of osteoarthritis pain in outdoor spaces entered using a more detailed measure of sensory stimuli that provide contact with nature.

### **Studies of Nature and Health**

While there is no lack of research suggesting that contact with nature is of benefit to health, specification is lacking regarding which aspects of nature are important, for whom, and in what circumstances (e.g., patient populations). In particular, there is limited research on the use of nature in outdoor environments as a distraction from persistent pain associated with chronic conditions. In 1984, a landmark study was conducted using the retrospective approach of a chart review (46 cholecystectomy patients; half with a window view of trees and half with a window looking out onto a brick wall).<sup>130</sup> The study findings led to the compelling suggestion that a view of nature not only reduced pain, but also was associated with several other positive health benefits. That study has been cited hundreds of times, but it was not until 2007 (reported in a 2011 publication) that a replication was conducted using a prospective design.<sup>196</sup> The results of this more recent quasi-experimental study (N = 472 cardiac and pulmonary rehabilitation patients) support the findings in the original (1984) study in that patients who had a view of nature reported better health. However, the later study report did not describe a measure of the patients' pain.<sup>196</sup> What makes these two studies important is the suggestion that looking out of a window with a view of nature (rather than a building) has a measureable impact on the health of particular patient groups.

### **Nature and Pain**

A review of literature on clinical studies involving nature<sup>26</sup> identified four studies that included acute pain and the use of visual representations of nature to distract from pain (see

Table 3.1).<sup>104, 125, 129, 197</sup> The studies were all randomized controlled trials (RCTs) that included auditory stimuli (two with nature sounds and two with music) as an intervention for pain. The results of these studies support the effectiveness of sensory distraction in reducing pain. It is noteworthy that none of these studies included instructions to participants about focusing attention or relaxation; the stimuli were presented as a distraction and no specific effort was requested of the participant. Each of the four studies included a comparison condition with visual nature-related stimuli and auditory stimuli. Additionally, because two of the studies directly compared the use of one stimulus (auditory<sup>129</sup> or visual<sup>125</sup>) to two stimuli (audiovisual), there is some suggestion of greater effectiveness with multi-sensory distraction.

The four studies described above, along with four additional studies published since the original literature review,<sup>26</sup> are included in Table 3.1. This table includes all of the RCTs on nature and pain conducted with patients in clinical settings that were located through multiple literature search strategies (including Pub Med, CINAHL, Web of Science, reverse citation, and hand-searches of article reference lists). All but two<sup>198, 199</sup> of the studies listed in Table 3.1 found statistically significant reduction of pain when nature-related stimuli were presented to participants as a distraction from pain. One study that did not find a difference between the treatment and control groups specifically noted that the usual care condition involved social distraction (staff engaging participants in conversation).<sup>198</sup> The other study involved bone marrow aspiration and biopsy patients;<sup>199</sup> but there was not a significant reduction in pain with the mural and sounds of nature, only a trend toward lower pain. Studies of sensory distraction from pain using other types of nature-related stimuli (e.g., olfactory) were not located. Related studies on the use of odor (lavender, orange, and apple) to reduce anxiety in dental patients have reported conflicting results.<sup>200-202</sup> Distraction appears to be effective in reducing pain, and nature

is a means of providing sensory distraction. However, further study involving specific patient groups (e.g., older adults with OA) and nature in outdoor settings is needed.

**Table 3.1. Randomized Control Trials on the Influence of Nature on Pain**

Author/Date	Sample	Intervention	Measures	Treatment Effects
Miller et al., 1992 <sup>197</sup>	N = 17 18 years and older Burn patients	Nature video with music	McGill scales <sup>a</sup> 165 burn dressings	Reduced pain with TX <sup>b</sup> PPI, $F=8.69$ ( $p = .01$ ) PRI, $F=5.57$ ( $p = .03$ )
Lembo et al., 1998 <sup>129</sup>	N = 37 50-74 years Sigmoidoscopy patients	Ocean scenes and ocean sounds	Visual Analog Scale (VAS) for discomfort	A/V <sup>c</sup> = 7.1 <sup>d</sup> A = 9.5 UC <sup>e</sup> = 10.8 ( $p < .05$ )
Diette et al., 2003 <sup>104</sup>	N = 80 21-90 years Bronchoscopy patients	Nature mural and nature sounds	5 point 1-item pain scale	Reduced pain with TX <sup>b</sup> Odds Ratio = 4.76 (95% CI = 1.35 - 1.67)
Lee et al., 2004 <sup>125</sup>	N = 157 16 -75 years Colonoscopy patients	Scenic views and classical music	10 point 1-item pain scale	A/V <sup>c</sup> = 5.1 <sup>d</sup> V = 6.2 UC = 7.0 ( $p < .01$ )
Drahota et al., 2008 <sup>198</sup>	N = 152 18 years and older Toenail surgery patients (injection of anesthetic)	Nature mural and nature sounds UC = staff engage patients in conversation	McGill PPI scale	A/V = 1.71 <sup>d</sup> UC = 1.47 ( $p = 0.279$ )
Park & Mattson, 2009 <sup>131</sup>	N = 80 Adult women Thyroidectomy patients	8 plants (in containers) in hospital room	Pain Intensity 0 to 100 scale Day 3 post op Pain medication <sup>f</sup>	TX = 67.60 <sup>d</sup> UC = 73.88 ( $p = .012$ )
Park & Mattson, 2009 <sup>203</sup>	N = 90 Adult women Hemorrhoidectomy patients	8 plants (in containers) in hospital room	Pain Intensity 0 to 100 scale Day 1 post op Pain medication <sup>f</sup>	TX = 63.27 <sup>d</sup> UC = 68.15 ( $p = .04$ )
Lechtzin et al., 2010 <sup>199</sup>	N=120 18 years and older Bone marrow biopsy patients	1. Nature mural nature sounds 2. City mural and city sounds 3. UC	VAS for pain (0 to 10)	Group 1 Nature = 4.86 <sup>d</sup> Group 2 City = 4.45 Group 3 UC = 5.14 ( $p=0.10$ )

**Note.** <sup>a</sup> McGill Scale includes present pain intensity (PPI) and pain rating index (PRI).

TX=Treatment . <sup>c</sup> Type of stimulus offered: A/V = audiovisual, A = audio alone, V = visual alone. <sup>d</sup>

Mean of scale scores. <sup>e</sup> Usual care (UC) that does not involve any other distracting stimuli. <sup>f</sup> Studies by Park & Mattson measured pain medication use over several post-operative days.

## Other Studies of Nature and Health

The above review focused specifically on studies regarding pain. Other evidence-based health benefits of contact with nature that have been examined in patient populations include reduced stress<sup>204</sup> and improved attention,<sup>205</sup> mood,<sup>206</sup> and quality of life.<sup>207</sup> While nursing scientists have conducted several of these studies, many different disciplines are engaged in this field of research, including medicine, psychology, environmental psychology, horticulture, occupational health, ecopsychology, geography, landscape architecture, urban planning, and public health. Several articles that review these studies<sup>13, 24, 25, 181, 208</sup> indicate that contact with nature is of benefit to health. One review, however, questioned whether these findings support the assumption that contact with nature is of benefit to health and noted the need for more rigorous research.<sup>24</sup>

An exemplar of rigorous research in this field was conducted by Cimprich and colleagues.<sup>209</sup> Their study used a clearly defined intervention involving contact with nature. A study to develop the intervention (N = 37)<sup>209</sup> was followed by a RCT to test it (N = 157).<sup>205</sup> There was a well-documented protocol for participants that measured their level of contact with nature.<sup>205, 209</sup> This intervention, based on Attention Restoration Theory, was developed to promote increased ability to concentrate (focus attention) in women following cancer treatments. The women recorded the amount of time spent each day in contact with nature and the type of activity selected from a list of suggestions, including viewing, listening, or being in nature (walking or gardening). The RCT showed a significant positive effect of increased capacity to concentrate for women who participated in the intervention group.<sup>205</sup>

There are an increasing number of studies examining the neighborhood built environment, and some measure of nature is included in these studies. However, there is a lack

of specific information regarding the type, quality, and level of contact with nature experienced by participants in these studies.<sup>14, 15</sup> In contrast, studies regarding the influence of nature with a clear definition of contact with nature often use only a very limited level of contact with nature (viewing) and frequently include participants who are healthy or about whom there is limited information regarding their health.<sup>210, 211</sup>

Studies regarding the influence of nature on the health of older adults with persistent pain and the influence of contact with nature on pain are limited. Older adults residing in a long-term care facility in Finland (N=30) reported frequently visiting the garden or going onto a balcony overlooking the garden.<sup>212</sup> More than half of the participants reported they went outside daily in the summer, and only one person reported visiting the garden infrequently. Forty-six percent of the study participants were depressed (based on a self-report instrument). Fifty percent of the participants reported that visiting the garden was associated with feeling less pain. Although less pain (with garden visits) was reported more often by participants who were not depressed (57.1%) than those who were depressed (41.7%), it was not a statistically significant difference ( $p=0.431$ ).<sup>212</sup> Research involving participants with depression and time spent in garden settings is particularly relevant because there is an association between depressed mood and pain.<sup>213</sup> Of particular note in regard to studies of older adults and depression are two studies that examined the effect of garden walking. Both of these studies used a Japanese garden as a place to provide a guided therapeutic experience with nature (while walking in the garden) for older adults with depression.<sup>214, 215</sup> These two studies found that spending time walking in the garden (in combination with another therapeutic intervention) improved mood.

## Conclusion

Although contact with nature has long been recognized as beneficial to health there is need for more research in this area. The POWER Study used SMT to guide this research on the symptom of pain because it provides a conceptual framework that supports research on an intervention involving the physical environment. In addition, the POWER Study systematically described the level of contact of with nature by using an objective tool to measure multi-sensory nature. This approach provided an opportunity for interpreting the information gathered from older women with OA and their pain *Symptom Experiences* in different outdoor environments. Furthermore, this approach helped to identify which of the relationships among key concepts in the symptom management process may be of particular importance and which of the many extraneous variables may be especially relevant when studying older women with OA pain. Thus, findings from the POWER Study will provide a foundation for future research on the influence of contact with nature on pain by generating testable hypotheses. The long-term goal of this research is to guide the development of environment-based *Symptom Management Strategies* by clarifying concepts such as *Why, Where, How, and How Much* with regard to pain management interventions for older women with OA and contact with nature.

## Chapter 4

### MEASUREMENT OF NATURE IN OUTDOOR SPACES

In order to conduct rigorous study of whether a physical environment may alter pain *Symptom Experience* (as a construct of the Symptom Management Theory; SMT),<sup>6</sup> it is necessary to identify and measure environmental elements that may impact pain. Contact with nature may divert attention away from pain through the mechanism of sensory distraction.<sup>26</sup> Contact with nature is a multi-sensory experience when elements of nature (of the sort that can provide different types of sensory stimuli) are close enough that a person can encounter visual, auditory, olfactory, tactile, and gustatory stimuli. Systematic investigation into whether experiences in outdoor spaces with different levels of contact with nature might affect pain depends upon the use of a valid and reliable measurement tool. To explore the *Symptom Experiences* of older women with OA when outdoors, the Pain of Osteoarthritis in Women: Environment Research (POWER) Study used an objective tool to measure the level of multi-sensory nature in the outdoor spaces (e.g., a courtyard) of retirement communities (RCs).

This chapter describes the process used to measure outdoor spaces in several RCs during the preliminary phase of the POWER Study in order to identify RCs with two outdoor spaces that had different levels of multi-sensory nature (one with a higher level and one with a lower level). The tool used to measure environment was based on the Access to Nature Outdoor Environment Tool (ANOET).<sup>216</sup> This revised version (ANOET-R)<sup>217</sup> provided increased specificity in the measurement of multi-sensory nature stimuli.

The chapter begins with a background section on outdoor environment measurement. The development of the ANOET-R is then described, including initial field testing. Outdoor space measurement, using the ANOET-R at RCs in order to identify sites for the POWER Study

and selection of RCs as study sites, is then presented. This chapter concludes with a discussion of the POWER Study findings in relation to measurement of outdoor environment spaces and future directions for research on methods used this area of inquiry.

## **Background**

### **Measurement of the Built Environment**

The built environment (i.e., those elements of the physical environment altered by humans) is increasingly studied for its potential impact on health.<sup>12</sup> Measures of outdoor built environments include both subjective (the environment as perceived by the user)<sup>218</sup> and objective tools.<sup>18</sup> These tools are used by researchers, policy makers, consumers, and others to evaluate or assess environments for a variety of purposes.<sup>12</sup> The tools are often designed to measure a neighborhood,<sup>12</sup> but may also measure a city,<sup>219</sup> a quarter mile radius from an address,<sup>220</sup> a park,<sup>221</sup> the grounds of a RC,<sup>20</sup> or a small defined outdoor space (such as a courtyard).<sup>216</sup>

There is an important distinction between built environment tools that provide subjective information about a person's perception of an environment versus tools that measure objective information through an audit or inventory of environment features.<sup>12</sup> The perception of an environment (by a user of the environment) is usually measured through use of a scale.<sup>222</sup> An individual's perceptions (arising from thoughts, feelings and experiences) are presumed to influence their responses to the environment. A scale measures a latent variable (e.g., feeling of security in an environment) and responses to items measuring the variable are expected to be highly correlated for a given respondent. In contrast, an index<sup>222</sup> would provide a list of environment features that contribute to an environmental variable (i.e., dimension), such as safety. This distinction between a scale and an index can be used to guide how the reliability and validity of a tool are evaluated.

Objective measures of the built environment can be used to provide an index of outdoor environment characteristics within a neighborhood (or other specified area) that incorporates various dimensions, depending on the purpose of the instrument (e.g. transportation or traffic, safety, physical activity, social, and aesthetic).<sup>18, 221, 223</sup> The aesthetic dimension of an outdoor environment includes the multi-sensory stimulation provided by nature. The aesthetic dimension is the extent to which there are features that are pleasing to the senses. Reliable and valid measurement of this dimension is recognized as particularly difficult.<sup>12, 16</sup> For example, Cunningham et al.<sup>18</sup> noted that the aesthetic dimension of the Senior Walking Environment Audit Tool had the lowest inter-rater reliability of the instrument's subscales (70%). The aesthetic (or pleasurability) subscale in another neighborhood inventory tool<sup>220</sup> and two reports of instruments that assess nursing home environments<sup>20, 173</sup> all indicate that tools measuring the aesthetic dimension of the outdoor environment have some methodological weaknesses. Two reasons the aesthetic dimension is difficult to measure are: 1) lack of clarity and agreement in the use of terminology such as 'attractive' and 2) difficulties inherent in measuring nature. Nature is complicated to measure because many aspects change rapidly (e.g., the presence or absence of birds, seasonal changes in plants). These challenges need to be addressed through continued development of tools that measure opportunities for contact with nature in outdoor environments.

### **Measurement of "Contact with Nature"**

Nature is recognized as both an important aspect of the aesthetic component of the built environment and a component of environments that may promote health.<sup>13</sup> There is variation in the extent to which built environment indexes measure nature. A critique of thirteen such tools found that the proportion of items involving nature ranged from 4% to 46% ,<sup>224</sup> though it is important to note that all of the tools included some nature-related items.

The geographic scope of a tool for measuring the built environment is an important aspect of that instrument. For example, accurate measurement of the aesthetic component in a large area is more difficult. Narrowing the scope of an environment index tool from a neighborhood to a specific outdoor space allows for a more detailed measurement of the aesthetic dimension. An "outdoor space" (with a boundary determined by the person using the tool) might be an entryway, a garden area, a terrace, or a courtyard. An older adult may routinely use outdoor spaces within a RC. The environmental features of spaces that are used routinely may have a greater impact than outdoor environments that are used only briefly. Outdoor spaces with RCs, therefore, provide an opportunity for studying whether environment features, in particular nature-related features, influence OA pain.

The ANOET is one of two environment measures located that specifically provides objective measurement of an outdoor space designed for use by older adults.<sup>22, 216</sup> Compared to the other tool (the Alzheimer's Garden Audit Tool),<sup>22</sup> the ANOET had greater relevance for outdoor spaces used by independently-living older adults. Furthermore, although the other tool has a higher percentage of nature-related items (46%),<sup>22</sup> compared to the ANOET (21%),<sup>225</sup> the ANOET has been evaluated for its reliability and validity.

### **Instrument Development**

#### **Original Tool: Access to Nature Outdoor Evaluation Tool**

The ANOET is an environment audit tool (i.e., an index) with a total of 63 items that are grouped into seven principles (dimensions).<sup>216</sup> This tool is intended to measure a 'space', such as a courtyard. The seven dimensions of the ANOET are Indoor-Outdoor Connections; Contact with Community; Safety and Security; Comfort and Accessibility; Freedom, Choice, and Variety; Contact with Nature; and Support for Activities. There are between 8 and 11 items per

dimension,<sup>225</sup> with each item rated on a scale of 0 to 10; a higher score indicates better access to nature. In contrast to other built environment indexes, the ANOET is based on the concept of affordances. An affordance indicates not merely the presence of a feature, but whether the feature supports a particular use by an identified user.<sup>216, 226</sup> The ANOET addresses two challenges to measuring nature: first, the items are written to avoid vague terms that tend toward personal opinion (such as "attractive"); and second, items measure, to the extent possible, either features that are not likely to change over time or account for expected seasonal changes.

The ANOET was developed through a process of extensive literature review, research,<sup>227</sup> expert consultation, and testing in 66 senior congregate housing settings (primarily assisted living) along with surveys of residents and staff in these settings.<sup>216, 229</sup> The surveys (administered concurrent with measurement of the environment) were designed by these researchers to better understand the relation between their objective measure and the resident and staff perceptions of the outdoor environment. One goal of testing the ANOET in senior congregate housing settings was to demonstrate validity in measurement of the Contact with Nature dimension. An item on the concurrent resident survey was perception of "enough greenery outdoors". A positive response to this item was significantly correlated with higher scores on the Contact with Nature dimension (0.428,  $p \leq .01$ ) of the ANOET.<sup>216</sup> The ANOET was selected for the POWER Study because it included this nature-related dimension (Contact with Nature). In addition, other dimensions of the ANOET were relevant to the use of outdoor spaces by older adults.<sup>229</sup> The inter-rater reliability of the ANOET has been reported as over 90% with an intraclass correlation coefficient of 0.93.<sup>216</sup> Therefore, there is evidence of the reliability and validity of the ANOET, and it continues to be evaluated. The developer notes that

refinement of this tool is continuing with updated information available on the Access to Nature website (<http://www.accesstonature.org/resources.html>).<sup>225</sup>

### **Access to Nature Outdoor Evaluation Tool - Revised**

**Multi-sensory addendum.** Although the ANOET provided the best available measurement of the outdoor environment for the purposes of the POWER Study, the Contact with Nature dimension included items primarily related to visual stimuli of nature. In order to have a more specific measure of different sensory stimuli available in the environment, a multi-sensory addendum (MS-Add) was developed with 14 new items that measure auditory, olfactory, tactile, and gustatory stimuli. The MS-Add items were based on the ANOET, the Alzheimer's Garden Audit Tool,<sup>22</sup> a review of relevant literature, and expert consultation with Dr. Susan Rodiek (one of the developers of the ANOET) and Dr. Lynne Manzo (environmental psychologist). The 14 new items were tested during a pilot study; additional information about this pilot study is presented below.<sup>217</sup>

**Multi-sensory Nature dimension.** The ANOET-R includes the seven dimensions of the original ANOET (63 items) and the multi-sensory addendum (MS-Add; 14 items) for a total of 77 items. This revision was undertaken with permission from the tool developer (S.D. Rodiek, PhD, email communication, November 2010) and consultation with her. A new dimension (Multi-sensory Nature; 27 items) is compiled from the new 14-item MS-Add combined with the 8 items of the Contact with Nature dimension and 5 nature-related items from other dimensions in the ANOET. The Multi-sensory Nature dimension items include: 11 visual; 4 each of auditory, olfactory, and tactile; and 3 gustatory). In addition, there is one new item regarding the extent to which a space affords enclosure, meaning the extent to which there is a clear boundary between inside and outside of the space. This item was added for two reasons: first, in

considering the effect of multi-sensory nature stimuli within the space, a more definitive boundary clarifies what is actually in the space and second, landscape architects who design therapeutic gardens consider a clear boundary to be an important design element.<sup>127</sup> The use of items from the original ANOET within the new dimension (Multi-sensory Nature) requires that any statistical analyses address this overlap with the ANOET Contact with Nature dimension. Because of the increase in items measuring different types of nature-related stimuli, the Multi-sensory Nature dimension provides a more specific measure regarding the level of multi-sensory nature stimuli in an outdoor space. The 14-item MS-Add is located in Appendix A.

The new MS-Add items were written with wording that was as close as possible to wording of items in the original too. Two of the original items were also revised slightly in order to clarify the type of sensory stimulus being evaluated. Table 4.1 shows how an original ANOET item was changed. From the original item there is a 1) revised item that includes only visual stimuli, 2) a new item is focused on olfactory stimuli, and 3) a new item regarding seasonal change in olfactory stimuli. The other original item that was revised had combined visual and auditory stimuli from animals. A person's response to hearing sounds made by animals depends on both the type of animal and the closeness of the animal. There is little sound to be heard when seeing squirrels (close up) or birds in the distance. In a space where dogs are allowed or where there is a pond visited by ducks, it is more likely that a person will hear these animals as well as see them. For each of the sensory types except gustatory, there is now one item related to stimuli considered to have a negative impact (either a new item or an original item). These ANOET-R items (congruent with the original ANOET items referencing something with a negative impact) were worded so that the presence of noxious stimuli resulted in a lower score.

**Table 4.1. ANOET-R Item Revision and New Item Examples**

<b>Original</b>	This outdoor area has plants with color, flowers, fragrance and/or seasonal change.
<b>Revised</b>	This outdoor area has plants with color, flowers, and/or seasonal change.
<b>New</b>	This outdoor area has plants with pleasant fragrance at the time of the assessment.
<b>New</b>	This outdoor area is likely to have pleasant fragrances from plants throughout the year.

The ANOET was designed for a broad range of users: older adults or their families, administrators of facilities for older adults, and researchers. As such, the brief item definitions (appropriate for use of the tool by non-professionals) lack precision in differentiating ratings on the 0 to 10 score for each item. Therefore, revision of the original tool included addition of more specific definitions for a majority of the items. In addition, the scores of 0, 1, 5, and 10 were further defined for certain items; and items that could be scored as 'not applicable' were identified. The original ANOET included information for scoring items on this 0 - 10 scale, without detail for scoring the overall scale. For the POWER Study, the individual items within each dimension were averaged to calculate a mean, 0 to 10 dimension score. If an item was scored as not applicable, that item was removed from the calculation of the mean. The overall ANOET score was calculated as the mean of the scores for the seven dimensions and ranged from 0 to 10. Overall ANOET-R scores, therefore, also ranged from 0 to 10 and included the mean of the MS-Add along with the means of the original dimensions. The Multi-sensory Nature dimension was not included as a separate component of the overall ANOET-R calculation because all items comprising this dimension are in the original ANOET and MS-Add.

Determining the reliability and validity of the ANOET-R proceeded in phases. Content validity of the MS-Add was increased through modification of items during field testing in the pilot study<sup>217</sup> in preparation for the POWER Study. Data were collected as part of the pilot study

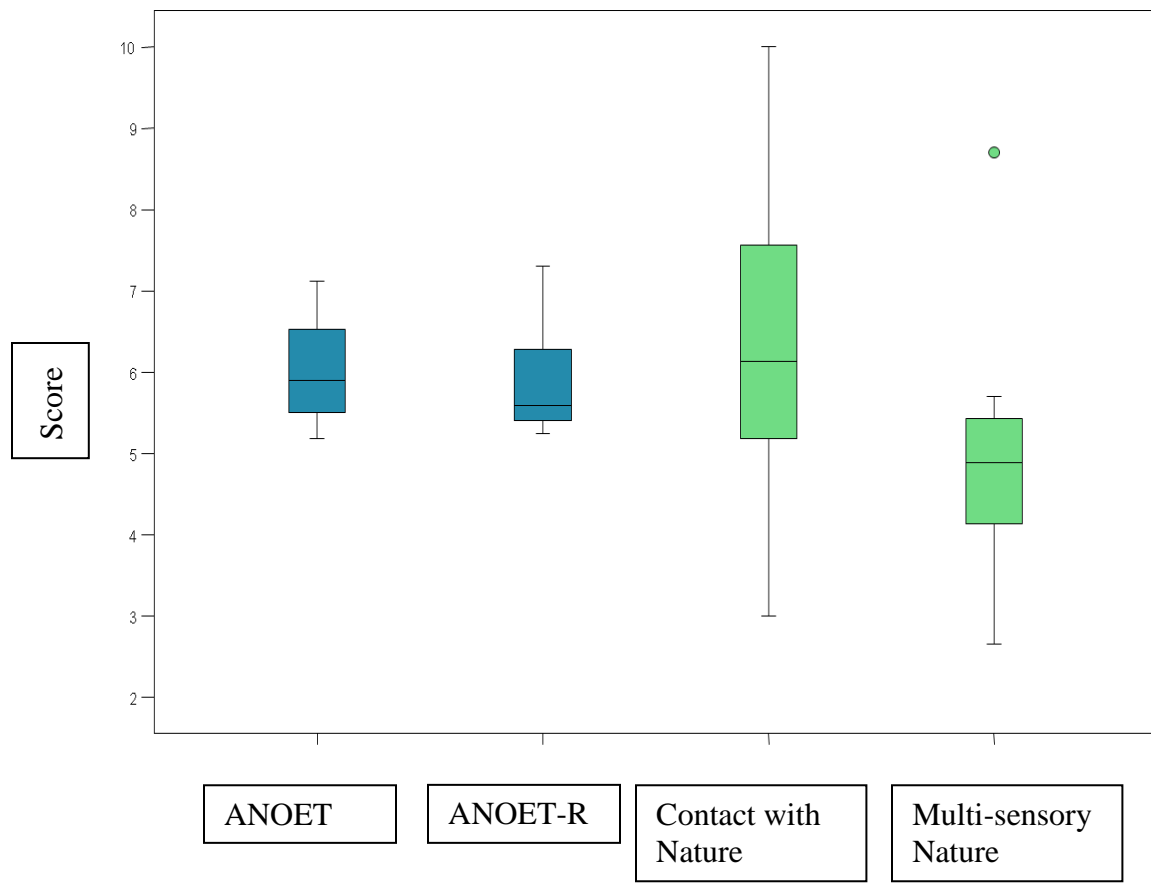
from eight RC sites in western Washington during the summer of 2010. Substantial revision of a preliminary version of the MS-Add was based on critique of the new items, field-testing, and consultation with the ANOET developer (Dr. Rodiek). Some of the original items (although unchanged in wording) were modified by adding more scoring detail.

### **Comparison of ANOET and ANOET-R**

The pilot study data reported here includes a total of 8 sites and 21 spaces (range of 1 to 4 spaces measured at the sites).<sup>217</sup> Three sites (10 spaces) visited prior to the final version of the MS-Add had only ANOET scores, and five sites (11 spaces) had complete ANOET-R scores. The principal investigator (PI), using paper forms while in the identified spaces completed the ANOET-R. Instructions for the ANOET were followed and additional notes were recorded to inform development of instructions for the ANOET-R. Data were then double-entered and checked for accuracy in Microsoft Excel (2007). The data were analyzed using SPSS Statistical Package version 16.0 (Somers, NY: IBM Corporation).<sup>231</sup>

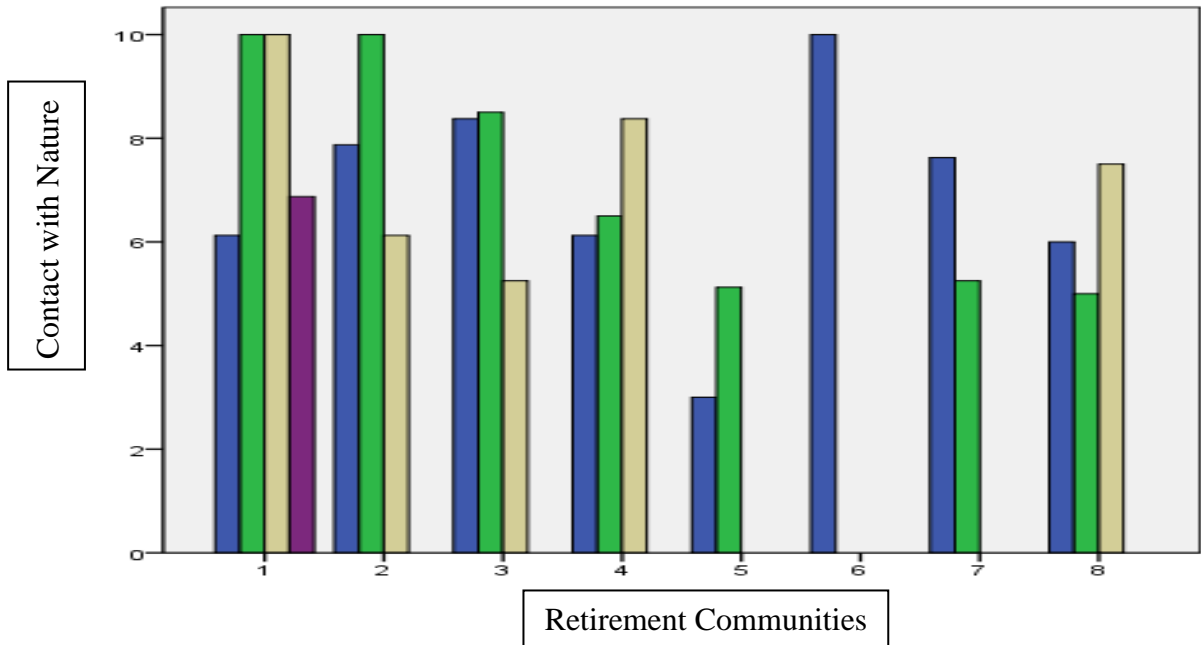
Overall instrument and dimensional scores on the ANOET and ANOET-R, as well as select individual items, were examined for overall distribution, errors, and outliers using measures of central tendency, frequency (e.g., histograms and scatter plots), and box-whisker diagrams. Figure 4.1 shows that overall ANOET and ANOET-R scores are similar, but the new Multi-sensory Nature dimension has a lower average score and more narrow confidence intervals than the overall scores. The ANOET and Contact with Nature data include all 21 space measurements, whereas the ANOET-R and Multi-sensory Nature data include only the 11 space measurements at the five sites with complete ANOET-R scores. Figures 4.2 and 4.3 show the nature dimension scores (Contact with Nature versus Multi-sensory Nature) for each space.

**Figure 4.1. Overall and Nature Dimension Scores on Original ANOET and New ANOET-R**



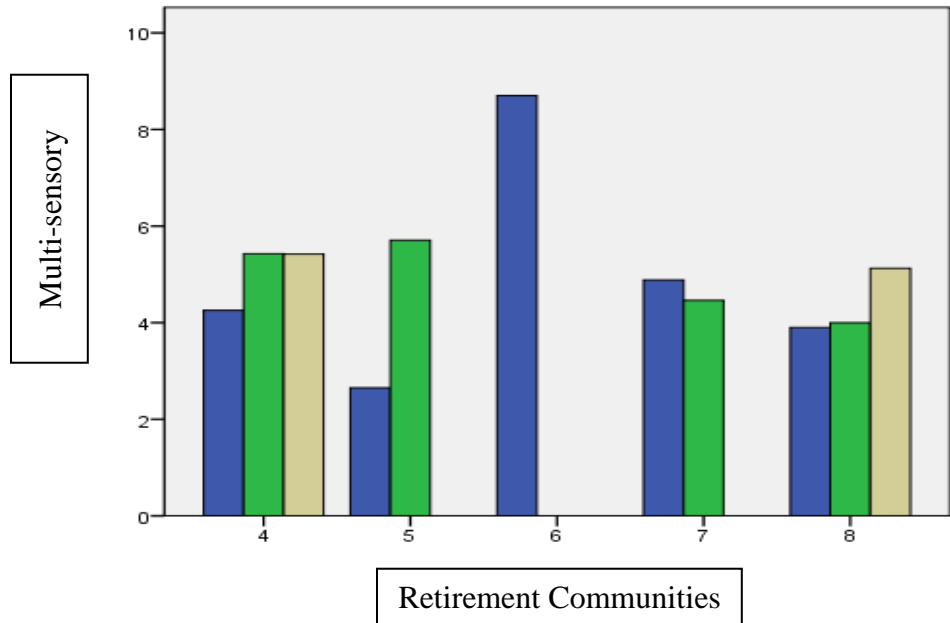
**Note.** Original = Access to Nature Outdoor Evaluation Tool (ANOET) and Contact with Nature dimension; New = ANOET-Revised (ANOET-R) and Multi-sensory Nature dimension. The ANOET-R includes 14 new items. The Multi-sensory Nature dimension is comprised of these new items and 13 items from the original ANOET, including the 8 items from the Contact with Nature dimension.

**Figure 4.2. ANOET Contact with Nature Scores**



**Note.** Spaces are clustered within retirement communities (RCs). Bar colors indicate specific outdoor spaces within each RC.

**Figure 4.3 ANOET-R Multi-sensory Nature Scores**



**Note.** Bar colors indicate specific outdoor spaces within each retirement community (RC) and represent the same space as the bar of the same color (by RC) in Figure 4.2.

The ANOET-R provides a feasible method to measure opportunities within outdoor spaces for contact with multi-sensory nature. The new Multi-sensory Nature dimension gives more detailed information with which to compare different outdoor spaces in a specific aspect of nature. A space with a lower score on the Multi-sensory Nature dimension has fewer opportunities for contact with multi-sensory nature. Specifically, the items provide information about the type of multi-sensory opportunities provided by nature that may contribute to engaging attention and thereby distract from pain.

### **Methods for Measuring Environment in the POWER Study**

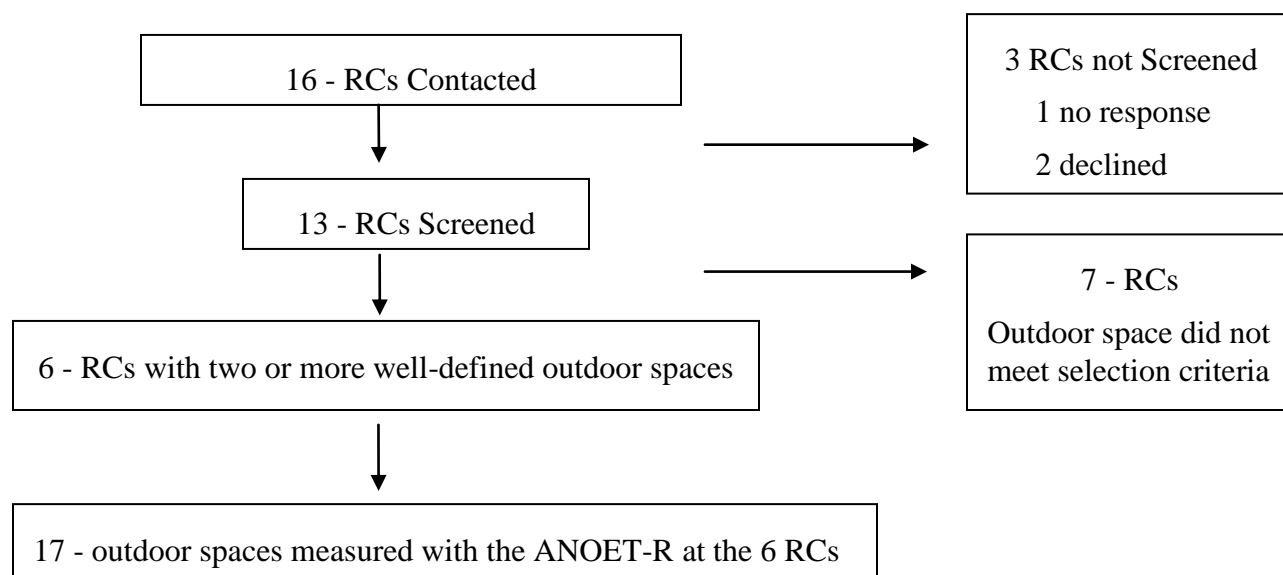
This section reports on use of the ANOET-R to measure outdoor spaces in RCs for the POWER Study. It begins with a description of the selection process for study sites, followed by a description of the data collection process. Data analysis is then described, including both the inter-rater reliability and comparison of ANOET-R scores between outdoor spaces at each study site. The RC sites selected for the POWER Study are discussed briefly. The chapter concludes with a discussion of the reliability and validity of the ANOET-R to distinguish between outdoor spaces in their level of multi-sensory nature.

### **Study Site Selection**

The study sites, retirement communities (RCs), were purposively selected for specific design features in their outdoor environments. The first step in this selection process was to screen several RCs identified within a major metropolitan area in western Washington. The goal of the screening was to identify RCs with two accessible outdoor spaces, over 100 independent apartments for older adults, and support from the RC administration allowing residents to participate in the POWER Study. The importance of having more than 100 apartments was to obtain an adequate sample size of women with OA. In addition, efforts were made to select RC

study sites that would vary by the form of administration (for profit; not for profit) and resident demographic characteristics. Variation in RC populations is consistent with the goals of conducting qualitative research<sup>232</sup> (to learn as much as possible about different experiences) and to describe confounding factors in RCs with different populations.

Screening was conducted by contacting RCs with greater than 100 apartments for independent-living residents. RCs were identified through multiple methods including telephone and internet listings. For RCs with multiple locations, only one of the communities was contacted. The RCs were contacted by letter and followed up by a phone call. Permission for the screening of RCs was obtained verbally from administrators of each community, who were willing to allow an onsite assessment of their RC's outdoor environment as well as resident participation in the POWER Study. However, permission for the environment measurement was not considered to be the formal permission that was obtained later for those study phases that involved participants. Screening of potential sites included meeting with a RC administrator, touring the RC, and determining whether there were at least two outdoor spaces. If so, then the spaces were measured using the ANOET-R. This measurement provided both the level of multi-sensory nature in the space, as well as overall characteristics of the space in regard to comfort and safety.

**Figure 4.4. Retirement Community Study Site Screening**

Several of the RCs screened had one well-defined outdoor space, but other outdoor areas were either too small or not easy to define as a space. Some communities had large outdoor areas with an expanse of grass and trees with a pathway, but without a definite boundary to clearly confirm that one was in a space. Open areas without clear boundaries presented two research challenges: first, it is difficult to define the space to be measured, and second, it is difficult for a survey respondent to answer a question regarding how much time is spent in the space when it is not a clearly-defined area.

The final selection of the four POWER Study sites from among the six screened RCs with outdoor spaces was based on factors not related to the outdoor spaces. RCs not selected included those in which the number of residents was close to or fewer than 100 and/or those that had a large number of non-English speaking residents. The RCs selected all had over 150 independent apartments; at least two outdoor spaces with one measuring higher and one lower on the Multi-sensory Nature dimension of the ANOET-R. Each space scored 5 or higher on the

overall ANOET-R. Invitations were extended to the four selected RCs, and all invited communities accepted.

The University of Washington Human Subjects Division was consulted regarding this Preliminary Phase of the POWER Study. They determined that as this preliminary phase only involved measurement of environment it did not require approval from the Human Subjects Division. Permission for conducting this Preliminary Phase was secured through the appropriate administrative channels of the RCs. For the communities selected to be included in the POWER Study, permission was obtained from the RC study sites for the POWER Study phases 1 and 2 (which involved study participants and will be addressed in chapters 5 and 6). Permission was also obtained to photograph the outdoor spaces at each RC selected as a study site; there were no people in these photographs. It is of note that the RCs were not provided with the results of the ANOET-R measurement before phases 1 and 2 of the POWER Study were conducted, in order to prevent changes related to the scores.

### **Environment Data Collection Procedures**

The procedures for data collection in the RC environment, management, and analysis were developed during the pilot study.<sup>233</sup> A manual was written for training in the consistent use of the ANOET-R. A research assistant with prior experience in using an environment tool was trained through three approaches: 1) reading and discussion of each item, 2) video prepared by the ANOET tool developer, and 3) hands-on experience using the tool in four outdoor spaces. The hands-on experience was followed by critique and discussion. Two spaces within each RC study site were measured by both the primary investigator (PI) and the research assistant.

The ANOET-R was completed using paper forms while in the identified spaces. Data were then double-entered and checked for accuracy in Microsoft Excel (2007). The data were

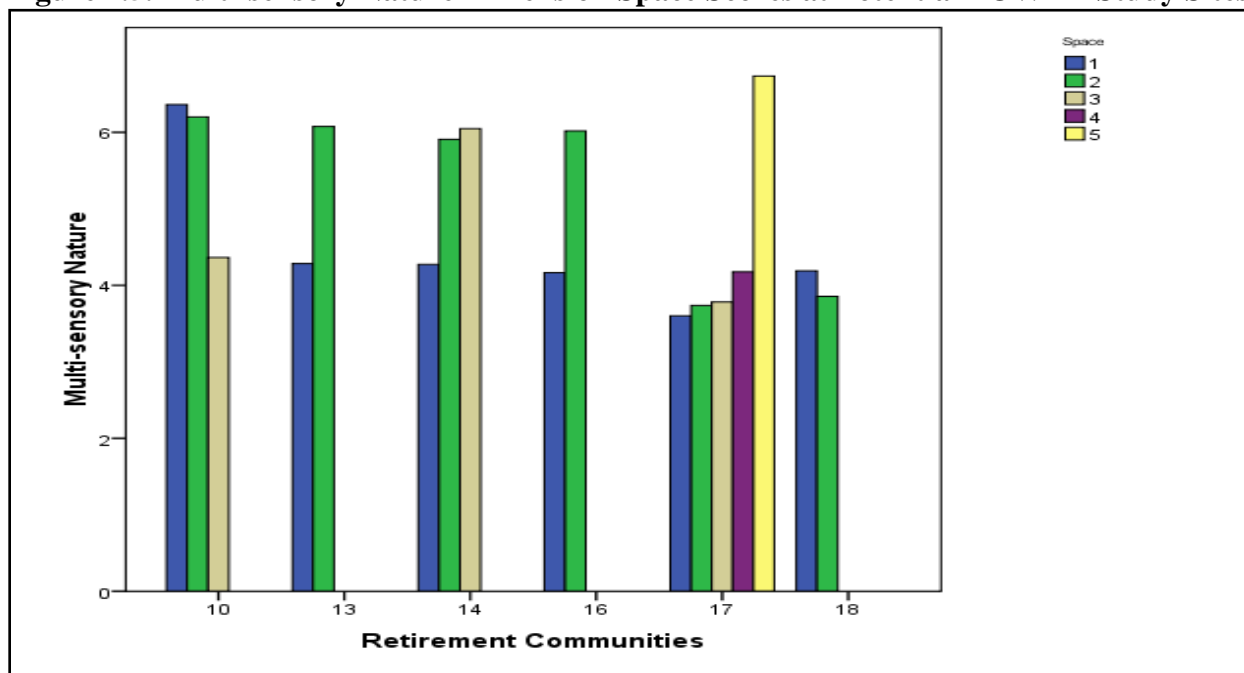
analyzed using SPSS Statistical Package version 16.0 (Somers, NY: IBM Corporation).<sup>231</sup>

Scores on the ANOET-R, including select individual items, were examined for overall distribution, errors, and outliers using measures of central tendency, frequency (e.g., histograms and scatter plots), and box-whisker diagrams.

## Results

The data reported here include six RCs and 17 spaces (range of 2 to 5 spaces at each RC). These data include both the four RC study sites and two of the RCs screened for potential inclusion in the study.

**Figure 4.5. Multi-sensory Nature Dimension Space Scores at Potential POWER Study Sites**



**Note.** Bar colors indicate specific outdoor spaces within each site, but do not correspond to the bars of the same color in Figures 4.2 and 4.3.

Figure 4.5 provides information about the Multi-sensory Nature dimension scores for the measured spaces (clustered by RC) located within the potential RC study sites. The RC labeled number 16 had scores on the Multi-sensory Nature dimension indicating that this site was a good fit for the study. However, the two spaces measured at this site were extremely different in both

size and purpose, with the smaller space reportedly used primarily by a specific group of residents. The site identification numbers used to identify potential sites during the preliminary phase of the POWER Study were changed after the study sites were selected.

**Validation.** In order to support the criterion validity of the ANOET-R Multi-sensory Nature dimension, additional description of the RC study site outdoor spaces is provided in Appendix B. This additional information further demonstrates the distinction between the spaces at each study site. The spaces with a higher level of multi-sensory nature contained both a greater amount of nature and a greater variety of sensory stimuli.

**Inter-rater reliability.** ANOET-R scores from ten spaces (within five potential sites) are included in the calculation of inter-rater reliability. This calculation involved all five sites measured by the two independent raters; four study sites and one RC screened for potential inclusion. Inter-rater reliability was calculated using an intra-class correlation (ICC) because the score is a continuous variable. Inter-rater reliability for the overall ANOET-R was 0.34 (ICC) and for the Multi-sensory dimension 0.50. Inter-rater reliability of the ANOET-R, original ANOET, and selected dimensions is presented in Table 4.2.

**Table 4.2. Inter-rater Reliability for the Access to Nature Evaluation Tool-Revised**

Statistic	Revised ANOET overall	Multi-sensory Nature	Original ANOET overall	Contact with Nature	Comfort and Access	Safety and Security	Freedom, Choice, Variety
Intra-class Correlation Coefficient	.34	.50	.41	.54	.58	.84	.80

**Note.** Two Independent Raters measured 10 spaces. There were two spaces at each of five retirement communities.

**Test-retest reliability.** Although there was an original plan to calculate the test-retest reliability of measurement of screened sites, this was not calculated as repeated measures were not done on most sites. The logistics of managing multiple visits to the RC sites within the constraints of a study with limited funding for staff and travel were mitigating factors.

## Retirement Community Study Sites

Three of the study sites were non-profit RCs and one was a for-profit RC. Study sites were categorized based on RC policies and fees, as having residents with higher or lower income; two RCs were in the higher income category and two were in the lower income category. The number of apartments for independently-living residents ranged from approximately 200 to 400; the specific number of apartments designated at a RC as independent varied somewhat based on vacancies and resident needs (e.g., some apartments were also licensed as assisted living residences).

At most of the RCs selected for the POWER Study there were more than two outdoor spaces. The outdoor spaces screened included four different types of spaces: Main (a centrally located space), Terrace (a space above ground level, usually with smooth flooring), Entryway (an entrance with an attached area that includes opportunities for activities beyond sitting on a bench by the door), or Secondary (similar to main, but not centrally located). At each RC study site residents had access to an outdoor space with a higher level of multi-sensory nature (score = 6 at each site) and an outdoor space with a lower level of multi-sensory nature (score = 4 at each site). Table 4.3 provides a brief description of the spaces selected at each study site. Additional information about the outdoor spaces is in Appendix B.

At one study site there were more than two spaces included due to proximity of specific spaces to resident buildings. At this RC study site some residents live in close proximity to an outdoor space that had a higher level of multi-sensory nature (score = 6). These residents had access to another outdoor space (two different spaces) with a lower level of nature (each score = 4). Additionally, some residents at this RC study site did not have comparable access to the two selected outdoor spaces. Consequently, Phase 2 data from 19 participants residing at this RC

study site were not included in the analysis of Aim 3 (because there was not equal opportunity for them to spend time in the specific spaces of interest for this study).

**Table 4.3. Summary Description of Selected Spaces at each Study Site**

Site	Comparison of Outdoor Spaces within Site	Congruence with POWER Study Aims <sup>a</sup>
1	Ground-level spaces Similar walking surface and furniture <sup>b</sup> Different in size and ease of access Larger area more easily accessible	Although there was variation in multi-sensory nature, the spaces at this site were the least appropriate for the purposes of this study because of the difference in size and access.
2	Terrace spaces Similar walking surface and furniture Similar in size and accessibility	The spaces at this site were the most appropriate of all the spaces for the purposes of this study.
3	Ground-level spaces Similar walking surface Different in furniture Different in size and access and purpose (one space was an entryway)	The spaces at this site were appropriate for the purposes of this study. The space higher in nature had the most abundant nature of any space in the study.
4	Mix of ground level and terrace spaces Difference in walking surface and furniture Different in size Similar in accessibility	This site was appropriate in terms of the variation in multi-sensory nature. However, the mix of ground-level and terrace spaces was not optimal.

**Note.** <sup>a</sup> Congruence with the POWER Study aims refers to the goal of comparing outdoor spaces that are similar in all respects except for level of multi-sensory nature. <sup>b</sup> Walking surfaces of ground-level spaces were paved with large, flat paving stones or poured concrete (similar to a sidewalk), all terrace spaces had flooring that provided a smooth surface. Furniture refers to outdoor seating and tables.

## Discussion

The results reported above demonstrate some of the challenges involved in developing valid and reliable measurements of multi-sensory nature in an outdoor space. While the ANOET and ANOET-R appear to be valid instruments for describing outdoor environment spaces, in the POWER Study there was limited reliability in the actual measurement of the spaces. The analysis of the inter-rater reliability indicates that neither the overall ANOET-R nor the Multi-sensory Nature dimension had a high degree of inter-rater reliability. In the POWER Study the overall original ANOET ICC (0.41) was far below the reported level for this tool (0.93).<sup>216</sup> The

agreement between raters in the dimension of Multi-sensory Nature was only slightly better (ICC=0.50). A higher level of agreement was found in dimensions measuring features that were less abstract; features involving safety (ICC=0.84) and features providing variety (ICC=0.80).

A number of factors may have affected the inter-rater reliability. First, the POWER Study data collection process increased specification for many items in the ANOET, through written definitions added to the tool. This specificity was intended to increase the reliability; however, it may have had the opposite effect. Researchers experienced in environment measurement had tested the wording of the original ANOET items extensively.<sup>216, 227</sup> In comparison, there was less evaluation of the wording for the expanded definitions added to ANOET items in the POWER Study. Second, the ANOET items were based on the concept of affordance, meaning that items measured whether residents of a RC (i.e., the individuals who use the space) would be able to use features in that space. Both of the POWER Study raters (the PI and research assistant) found it difficult at times to consider this more abstract question, rather than to report on the feature as present or not present. Third, due to logistical considerations, there was a time gap of as much as a month between measurements of the spaces by the two raters. Ideally, two independent raters should measure outdoor spaces on the same day.<sup>216</sup> Other factors that affected the ICC include the range of possible responses for each item (0 -10) and the small number of spaces measured (n=10). The range of responses for each item provided greater opportunity for disagreement between raters. The small number of spaces measured was more likely to show measurement extremes than measurement of a large number of spaces.

Measurement of the built environment is an emerging science.<sup>12</sup> Measurement of nature, a changing and complex component of outdoor environments, is particularly difficult.<sup>18</sup> An important component of outdoor space measurement is the square footage (size) of a space. In

three of the four pairs of spaces in the POWER Study the space with the lower Multi-sensory Nature score was also the smaller of the two spaces. However, despite the difficulties described above, some agreement was reflected in the ICC. Furthermore, narrative description of the spaces supported the measurement obtained with the objective tool. In future research, the reliability of measuring nature might be improved through more extensive training of raters, revision of the ANOET-R, or development of another tool.

Development of a new instrument to measure outdoor environments might begin by identifying dimensions using a conceptual framework linked to a health science theory. Inclusion of both subjective and objective measurements, for example, would be supported by the SMT. By targeting a specific patient population (such as older adults with OA) an instrument can focus more narrowly which aspects of the built environment might be measured to guide investigation of an environment-based intervention. The POWER Study was focused on the contribution of multi-sensory stimuli provided by nature, which may influence distraction from pain. However, there are many environment factors that may influence the *Symptom Experience* of older women with OA. Specifically, environment factors that influence physical activity are of particular importance because of the association between physical activity and pain in OA.<sup>89</sup>

### **Conclusion**

Based on the findings of this preliminary phase of the POWER Study there was sufficient evidence that each of the RC study sites had outdoor spaces with different levels of multi-sensory nature available to women residents. Outdoor spaces with greater variation in the objective measure of multi-sensory nature might have provided better indication of whether the level of nature contributes to time spent in an outdoor space. However, there was sufficient

difference found between the spaces measured for the POWER Study to compare the experiences of women with (and without) OA pain in these outdoor environments. There is a need for improved validity and reliability in the measurement of outdoor environments; this is particularly true regarding measurement of nature. Measurement tools based on well-established theory will help focus on dimensions of environment most important to the therapeutic needs of a target population.

## Chapter 5

### OLDER WOMEN WITH OSTEOARTHRITIS IN OUTDOOR ENVIRONMENTS

Osteoarthritis (OA) is a degenerative disease of the joints characterized by persistent, often daily, pain.<sup>1</sup> Joint pain associated with OA may be accepted by older adults (and their care providers) as a normal part of aging and tolerated to a greater extent than pain that is assumed to come from an injury or other illness.<sup>234</sup> However, treatment of OA pain is of particular importance as unmanaged pain can lead to decreased use of joints, which exacerbates the functional limitations of OA.<sup>70</sup> OA may affect joints in the hand, leading to impairments with basic daily activities such as difficulty dressing or preparing food.<sup>235</sup> Knee and hip OA impacts mobility and thereby decreases the amount of physical activity, contributing to the association of OA with cardiac disease.<sup>236</sup> With the increasing percentage of older adults in the United States<sup>2</sup> the public health and future financial consequences of undertreated OA pain are a growing national health care concern.

Gender differences in pain experience are now recognized, and there is a particular concern for women, as the majority of pain research has historically been conducted with mostly male subjects.<sup>3</sup> Women experience a higher incidence of most chronic conditions involving persistent pain.<sup>238</sup> Women are also at greater risk for co-morbid pain conditions than men, which, in turn, places women at greater risk for polypharmacy (associated with greater numbers of medication side effects and drug interactions).<sup>5</sup> Consequently, investigation of nondrug pain management strategies is of particular importance for the health of older women.

## Background

Pain is a symptom and therefore, by definition, a perception.<sup>6</sup> Pain perception arises from both peripheral and central processes. Nociception is the peripheral process involving activation of neural pain receptors by external stimuli. Nociception is an important component of pain, but is neither the only component nor required for the perception of pain.<sup>55</sup> The central nervous system, including wide spread brain regions, contributes to pain perception.<sup>45, 46</sup> In particular, central sensitization contributes to pain perception in chronic conditions involving persistent pain.<sup>52</sup> Central sensitization as a component of OA pain is now recognized, though not yet well understood.<sup>65, 67, 239</sup>

Symptom Management Theory (SMT)<sup>28</sup> includes a construct called *Symptom Experience* involving not only *Perception* of a symptom but also *Evaluation* and *Response*. The *Symptom Experience* construct provides a means for understanding the complex phenomenon of persistent pain. An increased understanding of pain experiences in the context of an intervention helps to guide the development and testing of that intervention, which is the purpose of SMT.<sup>6</sup>

Interventions for OA pain are comprised primarily of self-management strategies. These strategies include healthy lifestyle choices (e.g., diet, physical activity, sleep), arthritis-specific exercises, assistive devices to support joints, and mind-body approaches to reduce pain and stress.<sup>240</sup> Medications and surgery, if necessary, are also used to reduce pain.<sup>76</sup> The medications used are primarily non-narcotic pain relievers, but may also include opioids, antidepressants and neuropathic medications.<sup>241</sup>

Mind-body strategies are particularly important approaches to decreasing OA pain.<sup>91</sup> These approaches can contribute to lower use of pain medications over the course of many years. Decreasing the use of pain medication reduces health care costs, but more importantly can

decrease drug side effects as well as drug interactions from polypharmacy. Furthermore, pain prevention and reduction is a treatment strategy used to decrease development of central sensitization.<sup>41</sup>

Sensory distraction is a mind-body strategy involving the use of stimuli in the environment to engage attention and thereby divert attention away from pain. This form of distraction was described as "external focus of attention" by Fernandez and Turk in their classic article on different cognitive strategies to manage pain.<sup>105</sup> Although distraction is commonly used by older adults,<sup>242, 243</sup> the effectiveness of refocusing attention away from persistent pain with environmental stimuli is understudied. Nature-related stimuli are often used as the source of distracting stimuli and have been shown to promote reduction of acute pain.<sup>26</sup> Nature is also an important component of healing environments.<sup>244</sup> SMT predicts that the environment (including social, cultural, and physical components) will influence the pain symptom experience.<sup>6</sup> Research into an environment-based pain management intervention involving an environment with a larger "dose" of nature provides greater opportunity to measure an effect, if there is one. Dose in this context refers to both the amount and characteristics of nature, the variety of different sensory stimuli of nature, and the configuration of the nature, such as a small tree versus a tall tree that provides an overhead canopy. The research literature indicates that using multiple types of stimuli may provide greater diversion of attention from pain.<sup>26, 107</sup> The most abundant and novel forms of stimuli from nature are found outdoors. Landscaped spaces are often focused primarily on visual appeal; however, some outdoor environments have features that can provide access to rich multi-sensory nature including auditory, olfactory, tactile, and gustatory stimuli.

The purpose of the Pain of Osteoarthritis in Women: Environment Research (POWER) Study was to explore *Symptom Experiences* of older women with OA when outdoors as a foundation for future research on the influence of multi-sensory nature on OA pain. Two aims, addressed in this Phase 1 of the POWER Study, are presented in this chapter. The aims were to: 1) describe the pain *Symptom Experiences* of older women with OA in outdoor environments<sup>245</sup> and 2) compare and contrast women's descriptions of their outdoor *Symptom Experience* regarding two specific spaces in their retirement community (RC) that vary in the level of multi-sensory nature stimuli.

## Methods

### Design of Phase 1

An exploratory, cross-sectional design was used in this qualitative study to describe the OA pain *Symptom Experience* of older women. Qualitative description is a methodological approach that serves to "amplify the ... voices" of study participants.<sup>246</sup> This study is part of a larger mixed-methods study involving three phases of data collection from within four RCs. The POWER Study included a Preliminary Phase that described outdoor environment spaces (using an objective measure), followed by qualitative interviews of women with OA pain (presented here), and finally an anonymous self-administered survey of women residents with and without OA. The conceptual framework of SMT guided all phases of the POWER Study.

Approval for study activities with participants was obtained through the University of Washington Human Subjects Division, which granted Phase 1 of the POWER Study exempt status. Additionally, administrators at the four RC study sites gave permission for all portions of the POWER Study (environment measures, interview, and survey data collection), including

taking photographs of the outdoor spaces selected for this study. Permission from the RC study sites was formalized by a letter of agreement from an appropriate administrator at each RC.

### **Study Sites**

Four senior congregate housing settings (study sites; i.e., RCs with apartments restricted by age for older adults) were purposively selected for their specific outdoor physical environment characteristics. Each study site had at least two outdoor spaces that varied in the level of nature as measured by the Access to Nature Outdoor Environment Tool-Revised (ANOET-R).<sup>217, 225</sup> A component of the ANOET-R is an index of multi-sensory nature (i.e., nature features that provided visual, auditory, olfactory, tactile, and gustatory stimuli) with a range of 0 - 10. At each site there was an outdoor space with a lower score on the ANOET-R Multi-sensory Nature dimension index, indicating a lower level of multi-sensory nature and a space with a higher level of multi-sensory nature. This provided an opportunity for examining how different individuals responded to similar outdoor environment settings.

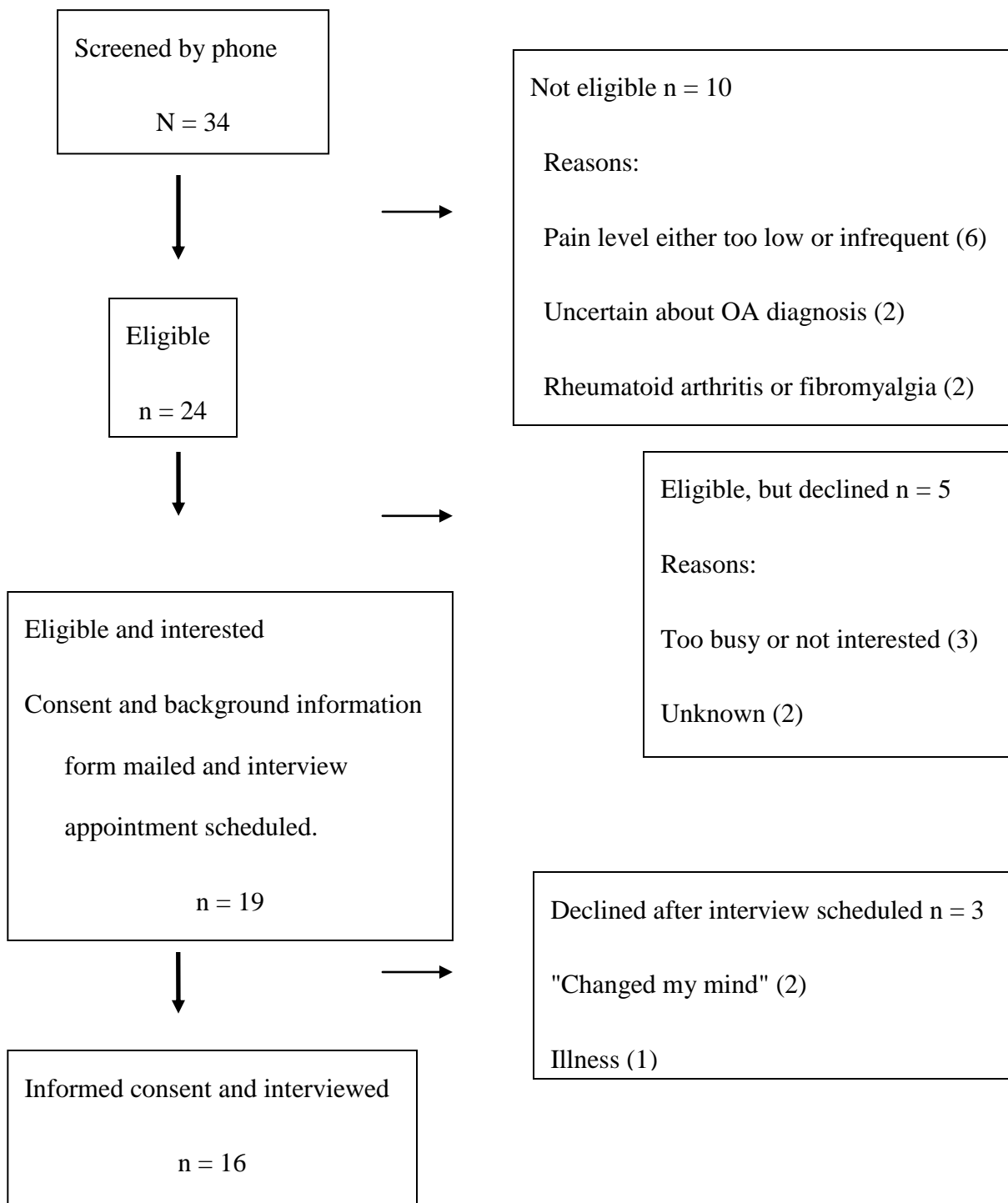
The selected RC study sites were comparable in that the outdoor environments were safe and accessible. Each RC study site had over 150 apartments for independent-living residents. All four RCs allowed pets and provided opportunities for residents to garden (e.g., raised gardening beds). Differences between the RC sites included the administration of the RCs with three that were non-profit and one for-profit. Two of the communities had only independent-living apartments, while the other two also offered higher levels of care (i.e., assisted living and skilled nursing). Two communities served residents with lower incomes (e.g., subsidized housing or income cap) and two served those with higher incomes (e.g., entrance fees). Three of the communities offered meals in a common dining room and one community provided no meal service. Three of the communities included residents who were predominately white and one

community had greater ethnic diversity; however, the actual distribution of ethnicity within the community is unknown.

### **Study Population**

The sampling plan for this qualitative study was designed to include individuals who were similar in diagnosis (OA), gender (female), age group (older adults), and residence (independent-living apartments of RCs). However, the goal of this qualitative research was to allow as much diversity as possible in other characteristics in order to learn about the breadth and depth of symptom experiences.<sup>247</sup> A range of different OA pain levels, ages, income levels, and types of RC settings were considered in the sampling plan.

The participants recruited for this study were women ages 65 years and older who reported a provider-diagnosed OA. All participants resided within one of the four RC study sites. At each site women were informed about the study through posted flyers and community announcements. Women were screened by telephone for eligibility. Figure 5.1 provides information about the telephone screening of women interested in the study. The inclusion criteria were OA diagnosis at least one year prior to the study (with current persistent pain attributed to OA), and independence in dressing, eating, bathing, and ability to go out of doors without assistance other than use of cane or walker. Persistent OA pain was defined as pain attributed to arthritis on a majority of days in the previous week (at least 4 of 7 days). The level of pain was a report of "worst pain" rated as a 3 or higher on a scale of 0 to 10, during the previous week. The exclusion criteria were inability to demonstrate understanding of consent information to provide informed consent, or use of a motorized scooter or wheel chair when out of doors, or who had chronic musculoskeletal conditions with pain features different from OA (e.g., rheumatoid arthritis and fibromyalgia), or who were non-English speaking.

**Figure 5.1 Screening of Participants**

## Data Collection Procedures

A consent form and brief background information form were mailed to women who were eligible and interested in participation. At the interview appointment, informed consent was obtained with participants signing consent forms prior to collection of any data. The background information form was reviewed and collected prior to the interview. Two women provided information on this form indicating either lower or less frequent pain than during the telephone screening. Review of this form with these two women indicated that the level or frequency was higher than they had indicated on the written form, so they were not excluded from the study. After study enrollment, participants were interviewed about their experience of OA pain and their experience in different outdoor places. The audio-taped semi-structured interviews averaged 42 minutes in length and ranged from 22 to 54 minutes. Interviews were conducted in the participant's apartment (except for one participant who asked to be interviewed in the RC library). All interviews were conducted during the summer months of 2011.

The interview instrument was developed to include items that focused on the SMT definition of *Symptom Experience*, which includes the *Perception*, *Evaluation*, and *Response* to OA pain. See Table 5.1 for sample interview questions and Appendix C for the complete interview guide. After questions about their experience with OA pain management and outdoor experiences in general, women were asked about their experiences in two specific outdoor spaces within their own community. Photographs of the two outdoor "spaces" at each site were shown to the women during the interview to assist in identifying and confirming the space under discussion. The order in which the higher and lower spaces were presented was alternated (i.e., half of the women were asked about the lower space first). The interview questions regarding their experience in the outdoor spaces were all asked twice (i.e., first for one space and then for

the other space). The interviewer was careful to avoid mention of differences between the two spaces in regard to their multi-sensory nature elements. A \$25 gift card was given to each woman after the interview was completed as a token of appreciation for their participation.

**Table 5.1. Interview Questions Linked to Symptom Management Theory Concepts<sup>a</sup>**

Question example	SMT concept
Tell me about how your joints feel when you are in this place.	<i>Perception</i>
What about this particular outdoor place affects how your joints feel?	<i>Evaluation</i>
What do you do, if anything, when you have arthritis pain or discomfort in this place?	<i>Response</i>

Note: <sup>a</sup> Symptom Management Theory (SMT) concepts in this table are part of the SMT construct of *Symptom Experience*.

The interviews were professionally transcribed and rechecked for accuracy against the recording of the interview. Interview transcripts (each as a separate document) were then imported into Atlas.ti software (version 6.2, 2010)<sup>248</sup> for management of text coding. Prior to coding, each interview was read and reread to enhance understanding of the overall interview. Then, the relevant portions of each interview (i.e., the portions regarding the outdoors) were identified for coding.

## Data Analysis

**Analytic approach.** The data analysis method used in this study was qualitative content analysis. Clarification of terms is important as terminology used in this method is not consistent among researchers.<sup>249</sup> In this study, each interview was considered a unit of analysis.<sup>249</sup> Within each unit of analysis are text segments or meaning units that are assigned codes. Codes are labels that describe and represent an aspect of the meaning unit.<sup>249</sup> Codes may be grouped together to create a code family; code families, in turn, may be grouped together within a larger category. In this study a meaning unit could be assigned multiple codes, including codes in different code families or categories.

Qualitative analysis of textual data from the interviews was conducted using directed content analysis (DCA).<sup>250</sup> Qualitative methods to conduct a content analysis may begin with either no predetermined codes or categories (i.e., conventional content analysis) or with predetermined codes or categories (i.e., DCA) based on a conceptual framework (e.g., theory) or identified through review of research literature.<sup>250</sup> Predetermined categories for this DCA were based on the SMT constructs: *Symptom Experience*, *Symptom Management Strategy*, *Symptom Status and Outcome*, *Health*, *Person*, and *Environment*.<sup>6</sup> Within the categories were predetermined code families based on concepts within the SMT constructs; for example the *Symptom Experience* construct encompasses three concepts, which are *Perception*, *Evaluation*, and *Response*. These three concepts have dynamic bi-directional relationships; "Symptom experience is a simultaneous perception, evaluation, and response to a change in one's usual feeling" (p. 147).<sup>28</sup> The *Symptom Experience* concepts may (and often will) be described as happening concurrently. For example, a person might say - I am rubbing my knee (*Response*) which is hurting (*Perception*) so much that I won't be able to get up (*Evaluation*).

The credibility of this DCA, and therefore the trustworthiness of the findings, was enhanced by multiple approaches. Two methodological experts in content analysis (one in nursing and one in environmental psychology) provided validation of the data coding and analysis in addition to consultation. Field notes, methodological and theoretical memos, and a self-reflective journal were written throughout the data collection and analysis process. In addition, an audit trail<sup>250</sup> was established and comprised of a study log and meeting notes from consultations.

**Coding process.** A coding manual was developed beginning with the definitions provided in the primary literature on SMT.<sup>6, 27, 28</sup> The categories and code families were

expanded and refined as needed based on the individual codes developed during the content analysis process. See Table 5.2 for coding manual example. Coding of the first two interviews included refinement and expansion of codes and code definitions. The consultants reviewed codes for two interviews, providing critique and suggestions. The consultants provided validation of the coding, but requested increased clarity in code definitions and noted the potential for bias with the use of predetermined categories and code families. Bias toward finding the expected (predetermined categories) is recognized as a limitation of DCA.<sup>250</sup>

**Table 5.2. Coding Manual Example: *Symptom Experience* Construct with Selected Codes**

Code Family Code	Definition	Clarification and or example quotation	
<b><i>Perception</i></b>	Patient report of a perceived sensation <sup>a</sup>	The perception code is divided into multiple components to capture different aspects of pain awareness. Perception is: <ul style="list-style-type: none"> <li>• Only an awareness of a sensation, (including an awareness of change in a sensation)</li> <li>• Not an expression of meaning or cause</li> <li>• Not an action or thinking about action</li> </ul>	
SyEx_Percpt_Pain <sup>b</sup>	Pain or discomfort; a sensation that is unpleasant	Pain experience is unique for each person and ranges from mild to severe. Unless the person's words suggest the pain experience is very mild, the text is coded as Pain.	<i>"I was walking down to the library last week, and going down the hill my knee was feeling the stabbing pain."</i>
<b><i>Evaluation</i></b>	Appraisal of the perceived symptom <sup>a</sup>	The person describes an experience pertaining to either the cause or impact of OA pain.	
SyEx_Ev_Impact <sup>c</sup>	What is the impact of pain on this person?	For example, the pain is a problem because it is interfering with function.	<i>"I still work in the yard and all of that. I probably just stopped a little earlier than the usual. "</i>
<b><i>Response</i></b> SyEx_Response <sup>d</sup>	Immediate reaction to alleviate symptom <sup>a</sup>	Unplanned, spontaneous actions in reaction to current pain	<i>"I would sit down and rub my knee"</i>

**Note.** <sup>a</sup> Concept definitions from Dodd, et al., 2001. <sup>b</sup> Code names have a prefix indicating the construct\_concept, in this case, SyEx\_Percpt\_Pain = *Symptom Experience (SyEx) Perception (Percpt)*. <sup>c</sup> SyEx\_Ev\_Impact = *Symptom Experience (SyEx) Evaluation (Ev) Impact*. This code specifically regards the evaluation of a symptom impact (as opposed to the evaluation of a symptom cause). <sup>d</sup> SyEx\_Response = *Symptom Experience (SyEx) Response*.

Based on this critique, the next stage of the content analysis was to redefine the unit of analysis as only the portions of each interview related to the outdoor environment (rather than the entire interview). Each unit of analysis (n=16) was then coded a second time using open coding (i.e., without predetermined codes or categories)<sup>251</sup> to stay as close as possible to the textual data and allow the codes to emerge directly from the data. This second round of coding was accomplished by creating a new folder with new document files for the units of analysis

(referred to, respectively, as a 'hermeneutic unit' and 'primary document' in Atlas.ti). Although not without bias (from previously developed codes), the new code names closely described the text. The new codes were then sorted into the SMT constructs (categories). After the sorting, there was a group of codes that did not fit into any of the categories. This group of codes all fit into a new category: Person-Environment Relation (P-E Relation). P-E Relation, although not a major construct in SMT, is one of the dynamic bi-directional relationships predicted by the theory. The codes assigned to each meaning unit were compared between the original codes and the second set of codes developed through open coding. This stage of the content analysis resulted in substantial revision of the coding manual by adding the above mentioned new category of Person-Environment Relation and clarifying code definitions in all coding families.

## **Results**

### **Sample Characteristics**

Participants were predominantly white (one Asian-American participant), single (81%), and used a cane (31%) or walker (31%) when outdoors. Most of the women had OA in two or more joints (81%) and had experienced OA pain for longer than five years (63%). Of the 16 women in the study, seven resided in RCs serving individuals with lower incomes and nine in RCs serving individuals with higher incomes. Table 5.3 provides more information about the sample characteristics.

**Table 5.3. Sample Characteristics**

<b>Sample Characteristics (N= 16 )</b>	<b>Mean</b>	<b>Range</b>
Age (years)	84.1 (SD 6.2)	70 - 92
Worst OA pain (previous week; 0-10 scale)	5.3 (SD 1.9)	3 - 10
Days/week with OA pain	6.2 (SD 1.5)	3 - 7

**Note.** Data presented are from background information form only and do not include information provided in-person during interview session.

### **Aim 1: Pain Symptom Experience of Women with OA in Outdoor Environments**

Descriptive themes were uncovered through examination of code reports. Code reports are the set of meaning units across all interview transcripts associated with a particular code. Meaning units with multiple codes occurred frequently, confirming the conceptual framework that predicts dynamic processes among the SMT constructs. Although greater attention was given to meaning units with the most frequently assigned codes, all code reports were reviewed. The descriptive themes included some that emerged from meaning units associated with a single code; other themes emerged from meaning units associated with multiple codes.

The original category (i.e., SMT construct) definitions were then examined for similarities with the descriptive themes. The themes could be aligned with the constructs of SMT, although one set of themes was aligned with the P-E Environment Relation category. See Table 5.4 and 5.5 for selected themes; these themes had more relevance to outdoor experiences, as opposed to themes that were as relevant to indoor symptom experiences. Short portions of meaning units (quotation examples) are used in Table 5.4 and 5.5 to highlight the aspect of the meaning unit that links to the SMT. All quotes in this table are from portions of the interviews related to outdoor experiences.

**Table 5.4. Themes Describing Symptom Experiences of Women in Outdoor Environments**

<p style="text-align: center;"><b><i>Symptom Experience: Perception (of OA Pain)<sup>a</sup></i></b></p> <p style="text-align: center;"><u>OA pain impacts frequency and amount of time outdoors.<sup>b</sup></u></p> <p style="text-align: center;"><i>"If I have back pain, I wouldn't be in a place like that [outdoors]; I would be in misery because the pain is so intense."<sup>c</sup></i></p> <p style="text-align: center;"><u>Assistive devices (e.g., cane / walker) can help manage pain while outdoors.</u></p> <p style="text-align: center;"><i>"It helps to have that cane to put some pressure on."</i></p> <p style="text-align: center;"><u>Walking outdoors can decrease OA pain.</u></p> <p style="text-align: center;"><i>"I was in misery until I started walking more."</i></p>
<p style="text-align: center;"><b><i>Symptom Experience: Perception (of Sense of Well-being)</i></b></p> <p style="text-align: center;"><u>Some women describe strong feelings of well-being when outdoors.</u></p> <p style="text-align: center;"><i>"I just feel good outdoors. ...I feel more expansive. I feel more - oh - lighter, probably, and refreshed."</i></p> <p style="text-align: center;"><i>"It's just brighter out and it gives you a lift."</i></p> <p style="text-align: center;"><u>Some women feel that when they are happy, and in a comfortable environment, their OA pain decreases.</u></p> <p style="text-align: center;"><i>"I like being there, so it makes me happy. And then I think your joints feel better when you're happy."</i></p>
<p style="text-align: center;"><b><i>Symptom Experience: Evaluation (of OA)</i></b></p> <p style="text-align: center;"><u>Women notice what makes OA better or worse.</u></p> <p style="text-align: center;"><i>"And if I move a lot, it gets better."</i></p> <p style="text-align: center;"><i>"Because, often, sitting at a table, I get pain in both of them, so I keep trying to stretch 'em."</i></p>
<p style="text-align: center;"><b><i>Symptom Experience: Response (to OA Pain)<sup>d</sup></i></b></p> <p style="text-align: center;"><u>Some women ignore OA pain when outdoors.</u></p> <p style="text-align: center;"><i>"I simply ignore it"</i></p> <p style="text-align: center;"><u>When outdoors women respond to pain in many different ways.</u></p> <p style="text-align: center;"><i>"I'd probably try to find a bench to sit on." "Well, I would get up and walk around. When I walk then it goes away." "...I suppose I'd come home and take half a pill or full pill, and just stay home."</i></p>

**Note.** <sup>a</sup>Headings in bold text represent the SMT construct: concept (e.g., *Symptom Experience: Perception*). <sup>b</sup> Sentences underlined in plain text are descriptive themes. <sup>c</sup>Quotes in italics provide meaning unit examples. <sup>d</sup>Quotes that informed this theme were in responses to the question: What do you do, if anything, when you have arthritis pain or discomfort in this place?

**Table 5.5. Themes Describing Person-Environment Relation of Women in Outdoor Environments**

<b>Person-Environment Relation<sup>a</sup></b>
<p><u>Each woman's attention is captured by different outdoor experiences.</u><sup>b</sup>  <i>"I have to get my hands in the dirt, that's all there is to it."</i><sup>c</sup></p>
<p><u>The relation between each woman and her outdoor physical environment</u>  <u>Influences where she walks.</u>  <i>"There are cracks in the sidewalk and it almost topples over my walker when I walk."</i></p>
<p><u>The relation between each woman and her outdoor social environment</u>  <u>influences how she feels outdoors.</u>  <i>"... it's very relaxing to be in the atmosphere of the people and warmth and friendliness."</i></p>

**Note.** <sup>a</sup>Heading in bold text is the new construct Person-Environment Relation. <sup>b</sup>Sentences underlined in plain text are descriptive themes. <sup>c</sup>Quotes in italics provide meaning unit examples.

Overall, the symptom experience of older women in outdoor environments is both individual and complex. The women in this study described OA pain as impacting the frequency and amount of time spent outdoors. For some women, being outdoors increased a sense of well-being and they felt this decreased their OA pain. Each woman's attention was captured by different outdoor experiences and for many women nature was an important part of these experiences. For example:

*"Some of the people have been gardening in those patches for years and they have lovely flowers and strawberry plants in the middle of it. I put in strawberry plants too; I don't know whether or not I'll get anything. It's fun just to watch it."*

*"...Look at the birds and see what they're doing. And there's cats that were kittens that also come to look at the [birds]- and so I'm involved. I like the cat."*

But for some women the social opportunities were of greater interest:

*"If I'm there [in the outdoor space] it's either because there's a social event or meeting there, so I'm concentrating on the people,..."*

In addition to engaging attention, there were many outdoor experiences (such as noticing a familiar tree) which prompted memories that connect with meaningful experiences from the past:

*"...Witch Hazel, the Witch Hazel trees. And I had one in my yard. But you have to get up close if you want to really smell them. They're not highly fragrant. But there's just a, you know, a freshness in the air because of the foliage and the flowers."*

The above quote shows engagement of attention through a multi-sensory experience that links to a positive past experience and enjoyment of the present moment.

The process of developing codes resulted in an expansion of the *Symptom Experience: Perception* concept to include not only the presence or absence of a symptom, but also a sense of well-being that may be present even though the symptom has not resolved. For example, a participant with OA in her hands expresses this sense of well-being:

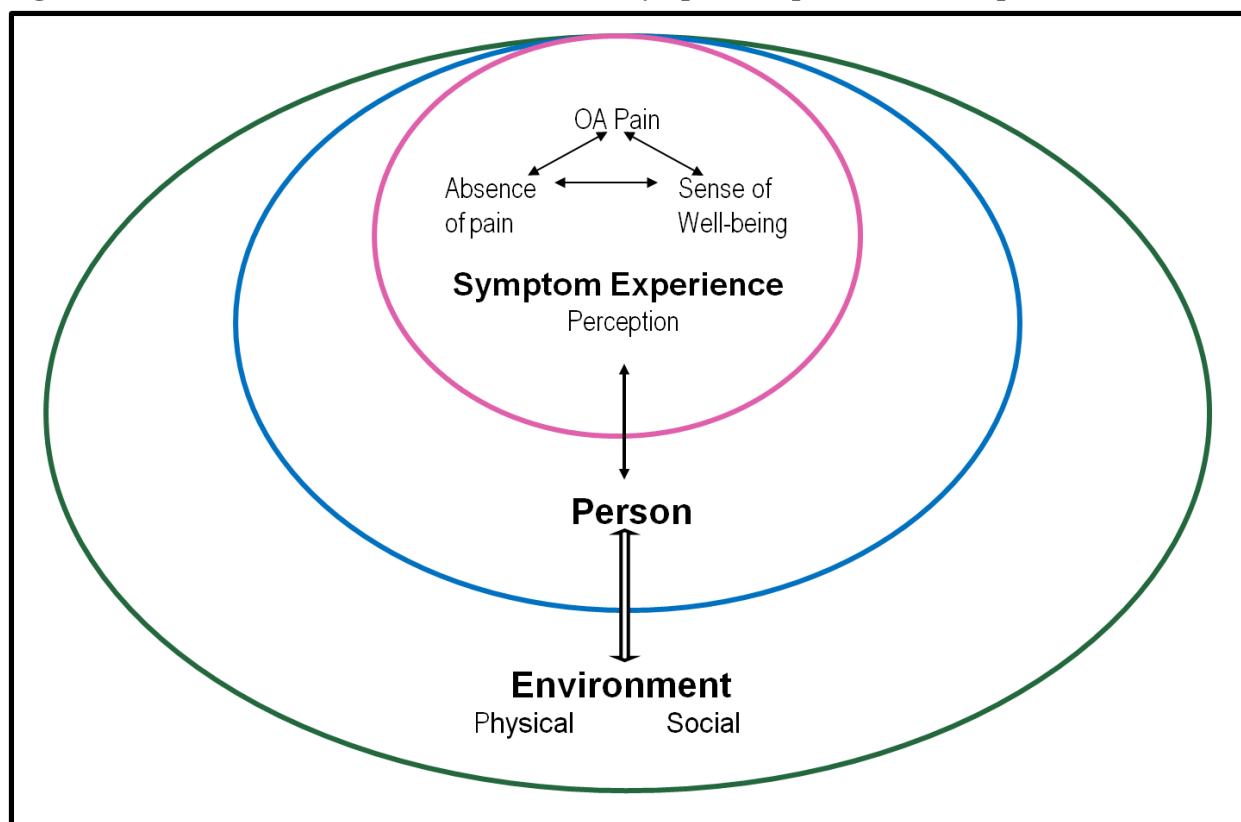
*"Well, in that place, it's a place of refuge really; being out of doors. And I love being - see, I grew up in the [Place] where we lived on orchards and always had huge gardens and that sort of thing. I have to get my hands in the dirt, that's all there is to it. So it's just a place I like to go. I don't always like to come back inside really, unless it's miserable."*

Expanding the definition of *Symptom Experience: Perception* reflects the richness of experiences for individuals with chronic conditions. The above quote, which includes, "I have to get my hands in the dirt,...", was preceded by the description of difficulties in dressing due to joint pain from hand OA. This is an example of perception of joint pain, absence of joint pain, and joint sensations that are pleasurable.

This analysis expands SMT in two ways; *the Symptom Experience: Perception* definition and the addition of category labeled P-E Relation. Figure 5.2 is a graphic representation of

selected constructs and concepts derived from the SMT diagram.<sup>6, 245</sup> In order to focus attention on this finding only the *Perception* concept is included with *Symptom Experience* and shows the non-linear relationship among the perceptions of pain, absence of pain, and sense of well-being, which are depicted with bi-directional arrows. This graphic has the *Symptom Experience* construct within the *Person* construct (oval) and the *Person* construct is within the *Environment* construct. The dynamic bi-directional relationship of a person with their environment in turn influences the person's perception of OA pain symptoms. The *Physical* and *Social* (but not *Cultural*) *Environment* concepts are included because these are the aspects of environment that were mentioned frequently by the women during the interviews.

**Figure 5.2 Person-Environment Relation and Symptom Experience: Perception<sup>245</sup>**



**Note.** Based on the SMT Model,<sup>6</sup> this figure uses selected SMT constructs and concepts in order to highlight the POWER Study findings. The findings expand (new construct of Person-Environment Relation) and revise (adds breadth to concept of *Perception*) SMT for the specific situation of older women with OA pain in outdoor environments.

An individual's *Perception* and *Evaluation* of particular environment characteristics (either *Physical* or *Social*) may influence their *Symptom Experience* (*Perception*, *Evaluation*, or *Response*). One example of P-E Relation is demonstrated by increased or decreased comfort regarding a sense of control. A participant used her cane to change her relation with an environment where she would otherwise feel vulnerable (i.e., not in control) into an environment where she feels greater control.

*"Well when I walk down to church, if it's raining, if it's wet underfoot, I've gotten so I take the cane, just as an additional prop.... It seems to give me a little more security."*

Additional examples of P-E Relation are provided above in Table 5.5, and give insight into the outdoor physical and social environment conditions that influenced these women's perceptions in regard to their experiences with OA pain when outdoors.

### **Aim 2: Pain Symptom Experience of Women with OA in Specific Outdoor Spaces**

The second Aim, describing the symptom experience in two outdoor spaces with different levels of multi-sensory nature was addressed after analysis of the first Aim was complete. Portions of text related to the spaces (with a higher or lower level of multi-sensory nature) were identified and reviewed to tally the number of meaning units associated with the Symptom Experience codes by participant and by space. One interview was removed from this analysis due to insufficient clarity regarding the space referenced in the interview. Few comments (i.e., meaning units) were made about OA pain in the specific outdoor spaces.

Only eight of the 15 women made comments about OA pain specifically in regard to the identified outdoor spaces. All but one of these comments was made by participants who reported a pain level of five or greater for the worst pain in the previous week. The total number of comments was 17, with eight in reference to spaces with a higher level of multi-sensory nature

and nine in reference to spaces with a lower level. There was no strong or consistent pattern seen in the meaning units indicating a difference in OA pain perception in spaces with higher versus lower multi-sensory nature.

Comments reflecting evaluation of pain (in terms of what might cause pain or the impact of pain) within the specific spaces were also very limited and no distinctions were found by space. There were many comments on the responses to pain, however no patterns were discerned in responses in regard to characteristics of a specific space. Most comments on pain responses reflected actions that were not specific to the place, for example:

*"Well, I would get up and walk around. When I walk then it goes away."*

Because both spaces in this woman's community provided places to walk, she could enact this response in either place.

Most participants made observations about nature in regard to both spaces, with more frequent mention of multi-sensory nature elements in the higher multi-sensory nature spaces. However, these observations were primarily about gardening (which was not available in three of the four spaces with a lower level of multi-sensory nature). The opportunity to garden provides rich multi-sensory experiences; however gardening can also lead to increased joint pain:

*"I definitely was full of aches and pains after I chopped out all of those roots. It took me several weeks to get all of those roots dug out, that I took out. .... But after working hard, I hurt."*

Three participants made little mention of nature, but this lack of narrative was consistent for these individuals in regard to both of the spaces. In addition to nature and other design features, most participants also discussed social environment elements (experiences and opportunities) in

both spaces, though somewhat more often in regard to the spaces with lower multi-sensory nature.

Some of the women observed that they expected to have lower pain because of features in or characteristic of the spaces. This included features that allowed access to nature, physical elements, and social opportunities. Some examples of these observations are:

*"...so I go in the rose garden and take the cane down and I leave it against the wall, and I just stand there and work on the roses without thinking about pain."*

*"All of this, the fresh air, the trees, the grass, the flowers."*

*"...so I just sit there and watch and then my friend comes up and so we just sit up there and visit. We both like the same things, so we'll sit up there and have coffee and just - and I feel okay out there, because I'm not really doing anything. I'm just sitting. "*

*" I was out there with friend yesterday and we had a little visit, and we both had brought our books, so we stayed out there on that nice terrace and read our books."*

Four women commented specifically on pleasant feelings when asked about how their joints might feel in a specific space. While two (of the four) women made these comments in reference to both spaces, the other two made the comment in reference to the space with lower multi-sensory nature. Overall there were so few comments regarding the OA pain experience that there is insufficient information to make a clear comparison regarding differences in the experiences of women within the two different spaces.

### **Discussion**

Themes describing the women's symptom experiences in outdoor environments supported the expected link to the SMT concepts *Perception*, *Evaluation*, and *Response*. This finding provides confirmation of SMT, an already well-established theory. However, the themes

prompt questions for further research. The *Symptom Experience: Response* theme of 'Some women ignore OA pain when outdoors', might be describing a woman successfully diverting her attention away from pain and towards engaging stimuli available in the outdoors. An alternate explanation is that a woman might be accepting pain as a part of aging and may be limiting her activity<sup>252</sup> as a consequence of ignoring pain rather than proactively managing OA pain. This example raises questions about the meaning and consequences of ignoring OA pain.

The refinement of the *Symptom Experience: Perception* concept to include sense of well-being particularly informs the circumstance of persistent pain from a chronic condition. SMT is intended for broad application to both acute and chronic symptoms.<sup>6</sup> This highlights the importance of developing a situation-specific model that takes into account the population and condition in relation to the symptom management strategy under investigation. The refined definition recognizes the breadth of symptom experience for individuals with chronic conditions. Their experience is not solely a transition from pain to absence of pain, but instead is richly nuanced with states that range from excruciating joint pain to absence of pain to experiencing pleasure and joy in moving within their environment. This argument is supported by a phenomenological study of older women with OA.<sup>68</sup> The potential for a pain management strategy to contribute to a sense of well-being is particularly of note as quality of life has been identified as a patient outcome of importance to individuals with chronic pain.<sup>40</sup>

Sandelowski has observed that quantitative descriptive methods constrain what is found in contrast to qualitative description, which may extend beyond the expected data.<sup>253</sup> Although Person-Environment Relation is not a construct of SMT, it is a predicted relationship in the Dodd and colleagues' 2001 list of underlying assumptions of the earlier Symptom Management Model.<sup>6</sup> Environment is described as affecting and modifying the constructs of *Symptom*

*Experience, Symptom Management Strategies, and Symptom Status and Outcomes.*<sup>6</sup> Although there is no bi-directional arrow for P-E Relation on the SMT diagram,<sup>6</sup> it is implied.<sup>28</sup>

The emergence of P-E Relation as an important construct in the circumstance of older women in outdoor environments is in alignment with literature on aging and environment.<sup>150, 160, 195</sup> Identification of a conceptual link between a well-established theory on symptom management and major theoretical approaches to aging and environment will provide support for the further conceptualization of the P-E Relation construct. The situation-specific circumstance of older women with OA in outdoor environments needs further elaboration to inform the development of interventions to support OA pain self-management.

The descriptive theme 'Each woman's attention is captured by different outdoor experiences' (see Table 5.4) exemplifies the individualized nature of the P-E Relation. However, it also points out the challenges in designing an outdoor environment to meet the needs of many different people. Landscape architects who specialize in the design of healing and therapeutic gardens emphasize that an important characteristic of these spaces are design features that offer choices to meet the needs of people with different interests.<sup>127, 216</sup> There are many elements of built environments that are recognized as supportive of well-being for most people,<sup>254</sup> but there is much more to be learned through investigating the relation of person and environment that can inform the design of outdoor environments that may contribute to health.

There were several limitations to this phase of the POWER Study. Overall the women discussed their outdoor experiences and their experiences with pain, but less was said about their pain experiences when outdoors. The sampling plan goal was to enroll women with a range of pain levels in order to understand the different experiences. It may be, however, that restricting enrollment to women with higher levels of pain might have resulted in more comments about

pain when outdoors. The relatively few comments about pain when outdoors may be related to an inclination to stay indoors on days when a woman is experiencing more pain. It is also possible that going outdoors distracts from OA pain to such an extent that a woman would not comment about it.

Another limitation of the study is that all the interviews were conducted indoors, rather than in actual outdoor spaces. Outdoor interviews might have resulted in very different findings. Further insight could be attained by asking a participant to take the researcher to outdoor spaces of interest to the participant. The generalizability of findings may have been influenced by the lack of ethnic diversity in the population, the single geographic region, and type of residence (i.e., RC) from which the sample was recruited. Time of year (summer) may have also influenced the findings; in particular the women might have responded differently to interviews during winter months. However, if future studies are conducted outdoors it is likely that a time of year with mild weather conditions will be selected for practical reasons.

The difference in the level of multi-sensory nature between the two spaces at each RC study site was small (a score of 4 versus 6 on a scale of 0 to 10). This was a naturalistic study (no alterations were made to the RC outdoor environments), therefore identification of comparable RCs with two outdoor spaces had to be balanced with variation in level of multi-sensory nature within the spaces. In future research alteration of the outdoor environment to provide greater variation may result in clearer differentiation of responses to level of multi-sensory nature.

The use of DCA posed a challenge in that there is a potential to be biased in the direction of the predetermined categories. This challenge was increased because the analysis was conducted by one individual. However, these challenges were addressed by close consultation

with two methodological experts, an audit trail, and free-coding to check the predetermined categories. These strategies provided significant support to the analytic process and assisted in supporting the credibility of the findings.

### **Conclusion**

The findings from this first phase of the POWER Study have contributed the development of a situation-specific model with two additions to the SMT diagram based on the findings presented above. The concept of *Perception* (of OA pain by older women in outdoor environments) was extended to include a sense of well-being. An implied relationship was made explicit by uncovering the importance of P-E Relation to older women with OA pain when outdoors. The process of DCA using a well-established theory (SMT) led to increased understanding about the experience of older women with OA pain. These findings from the first phase of the POWER Study have facilitated insights that will be of use in the development of a mind-body intervention for women with OA pain.

**Chapter 6:**  
**TIME SPENT OUTDOORS BY WOMEN**  
**WITH AND WITHOUT OSTEOARTHRITIS**

This chapter describes Phase 2 of the Pain of Osteoarthritis in Women: Environment Research (POWER) Study that had an overarching goal of informing future research on environment-based interventions for osteoarthritis (OA) pain. The POWER Study incorporated the conceptual framework of Symptom Management Theory (SMT)<sup>6</sup> throughout, including all the domains (*Health, Person, and Environment*) and dimensions of the symptom management process (*Symptom Experience, Symptom Outcomes, and Symptom Management Strategies*). The study evaluated outdoor environment spaces using an objective measure (preliminary phase) and described outdoor pain *Symptom Experiences* of older women with OA using a qualitative method (Phase 1). The aim for Phase 2 of the POWER Study was to describe the extent to which the level of multi-sensory nature in outdoor spaces that women enter and person factors (OA, bodily pain, and functional status) are associated with time spent outdoors. A review of literature regarding the background for Phase 2 is located in Chapter 2.

**Methods**

**Design of Phase 2**

A multi-site, cross-sectional, descriptive design was used in Phase 2 of the POWER Study regarding the amount of time older women (with and without OA) spend outdoors. Approval for study activities with participants was obtained through the Human Subjects Division of the University of Washington, which granted Phase 2 of the POWER Study exempt status. The study sites also gave formal written permission for us to conduct site-specific aspects of the POWER Study (environment measures, interviews, and survey data collection).

## **Study Sites**

Four retirement communities (RCs) were purposively selected as study sites for their outdoor physical environment characteristics. The "Study Sites" section of Chapter 5 describes these RC study sites. The outdoor spaces within each RC study site are described in Chapters 4 and 5.

## **Study Population**

For Phase 2 an anonymous self-administered survey was delivered to residents at each of the four RC study sites. An information sheet about the study was included with each survey, describing the purpose of the survey and the fact that it was intended for female residents only. All women residing in independent-living apartments within the RC study sites were invited to participate in the survey. Information about the study and survey was also provided to residents through on-site community meeting announcements and brief newsletter articles. The surveys were returned in collection boxes available at the RCs or by mail using a pre-addressed postage-paid enveloped provided with the survey.

## **Measures**

The measures for this study were selected to operationalize the major constructs of the SMT: *Health, Person, Environment, Symptom Experience, Symptom Status and Outcomes*, and *Symptom Management Strategy*. With the exception of *Environment*, all measures involved the women's self-report by means of the survey. The 64-item POWER Study survey included both well-established and investigator-developed items addressing components of SMT constructs (the POWER Study survey is located in Appendix E). The investigator-developed items were based on a literature review and consultation with experts in aging and pain research. Constructs for the study are described below.

**Environment.** The SMT construct of *Environment* includes three concepts: *Physical*, *Cultural*, and *Social*. The *Physical* concept was measured and completed prior to distribution of the survey (i.e., during the Preliminary Phase of the POWER Study). Objective measurement of outdoor spaces at each study site was accomplished through use of the Access to Nature Outdoor Evaluation Tool-Revised (ANOET-R).<sup>217</sup> The ANOET-R was revised from the original ANOET<sup>216</sup> through addition of a M-SN Addendum (M-SN Add) comprised of new (14) and original (13) items; balanced among different sensory types (i.e., nature features that provided visual, auditory, olfactory, tactile, or gustatory stimuli; see examples in Table 6.1). As described in Chapter 4, at each RC study site there were outdoor spaces identified that met the criterion of having either a higher level of multi-sensory nature (M-SN) or a lower level. Each higher level space had a score of 6 and each lower level space had a score of 4 (scale of 0 - 10). The high versus low relationship between the spaces at each site, in terms of MS-N, is described in Appendix B.

**Table 6.1. Examples of Multi-sensory Nature Items in Access to Nature Outdoor Environment Tool - Revised**

Type of Stimuli	Item Example
Visual	Residents can see trees and / or other tall plants. <sup>a</sup>
Auditory	Residents can easily hear a water feature (or some other feature that produces pleasant sounds).
Olfactory	This outdoor area has plants with fragrance at the time of the assessment.
Tactile	Residents can easily touch nature of different types and textures.
Gustatory	Residents can easily reach edible plants that are available for them to enjoy.
Auditory (Noxious )	Residents are not exposed to noise pollution.

**Note.** <sup>a</sup> Visual item is from the original ANOET<sup>225</sup>; all other items are new (sometimes there are only slight word changes from the ANOET to confine the item to a single sensory category).

**Person.** The SMT construct of *Person* encompasses multiple concepts (see Chapter 2, Figure 2.1). The POWER Study survey included investigator-developed items to collect

demographic and psycho-social characteristics. Psycho-social characteristics included the woman's reasons for choosing the RC and her current outdoor activity preferences.

**Health.** The SMT construct of *Health* includes the health condition related to the symptom of pain, health status, and risk factors. Health condition was measured by a self-report of provider-diagnosed OA (see Table 6.2 for item wording), followed by asking about joint involved and length of time since diagnosis. OA status was determined as follows: if a woman marked that she had provider-diagnosed OA, then she was categorized as 'with OA'; if she marked no, then she was categorized as 'without OA'. Any other response (e.g., not checking yes or no but identifying joints involved, written comments indicating that she was uncertain about OA diagnosis) was considered missing and excluded from analyses involving OA. Although this conservative method resulted in few women being included in the OA status groups, the approach also avoided potentially misclassifying women.

There was a one-item, self-rated health question from the RAND 36-Item Health Survey 1.0 (RAND 36)<sup>255</sup> that asked respondents to rate their health on a 5-point scale from excellent to poor. Both the RAND 36 and the Medical Outcomes Study 36-item Short Form (SF-36) have nearly identical items, with some differences in scoring calculations. Both versions of the form have strong psychometric properties.<sup>255</sup> The RAND 36 (which is in the public domain)<sup>256</sup> and SF-36 are used extensively in health research. The scoring on these scales uses a higher score to indicate better health (e.g., greater pain = lower score).

**Table 6.2. POWER Study Survey Item Examples and Response Options <sup>a</sup>**

<b>Construct: Concept</b>	<b>Item</b>	<b>Response options</b>
<i>Health:</i> OA diagnosis	Has a health care provider told you that you have osteoarthritis? (Osteoarthritis is <u>not</u> the same thing as rheumatoid arthritis or osteoporosis.)	Yes / No
<i>Symptom Management Strategy:</i> <i>How much?</i>	How many days do you usually go outdoors each week?	0 to 7
	About how much time do you spend outdoors on a <u>usual</u> day, when the weather is nice? If you go outdoors more than one time a day, what is the <u>total</u> time you are outdoors?	Categories: 0 Less than 15 minutes 15 minutes to one hour More than an hour

**Note.** <sup>a</sup> Items in the survey were linked to concepts with the Symptom Management Theory constructs.

***Symptom Experience.*** The SMT construct of *Symptom Experience* involves three concepts: *Perception*, *Evaluation*, and *Response*. *Perception* and *Evaluation* were measured with the two-item bodily pain scale from the RAND 36.<sup>255</sup> This scale asks about perception of bodily pain and evaluation of pain interference with work (including work in the home) during the previous four weeks. It was anticipated that women (with or without OA) would answer this question in reference to bodily pain not only from OA, but also from other causes.

*Response* to pain was only measured in terms of what the woman took for pain (e.g., medications, vitamins, supplements). This item was a yes/no question, "Do you currently take anything for pain?" If the response was yes, then the woman was asked to write what she took for pain. Non-drug pain management strategies were not assessed in this survey to limit the number of items in the survey.

***Symptom Status and Outcomes.*** The SMT construct of *Symptom Status and Outcomes* involves several concepts (see Chapter 2, Figure 2.1). The concepts measured for this study included *Symptom Status* (arthritis-specific), *Functional Status*, *Emotional Status*, *Co-morbidity*,

and *Quality of Life*. *Symptom Outcomes* concepts not included on the survey were *Self-care*, *Morbidity*, and *Cost*. Three of the concepts (*Symptom Status*, *Functional Status*, and *Emotional Status*) were measured using the Arthritis Impact Measure Short Form 2 (AIMS2-SF) scales (Symptom, Physical, and Affect, respectively).<sup>257</sup> The AIMS2-SF scale scores were calculated according to the instrument's instructions. The AIMS2-SF (with a total of 26 items) uses a 5-point scale for the response options. The validity and reliability of the instrument has been assessed as similar to the original full Arthritis Impact Measurement scale (57 items) for patients with OA.<sup>257</sup> Internal consistency of the AIMS2-SF scales has been measured using Cronbach's alpha: the Symptom scale was 0.80, Physical scale was 0.86, and Affect scale was 0.84.<sup>259</sup> Permission was obtained from the AIMS2-SF developer to use all items, incorporating their exact wording and ordering within the POWER Study survey (F. Guillemin, PhD, email communication, May 2011). Although reliability and validity of the AIMS2-SF has not been established for women without arthritis, in this exploratory study the scales nonetheless provided comparable measures of arthritis-specific *Symptom*, *Functional*, and *Emotional Status* for women with and without OA.

*Co-morbidity* was measured by a count of activity-limiting health conditions (total possible count 13) including a check list with 11 items - 10 health conditions and an 'other' option for the respondent to write in a condition and two separate items for measurement on hearing and vision. The checklist of activity-limiting conditions was derived from the CDC Health Related Quality of Life (HRQL) questionnaire.<sup>260</sup> Because these items were modified and used without the rest of the HRQL questionnaire, along with the addition of hearing and vision items, their validity and reliability were not established.

*Quality of Life* was measured with a single 5-point item, ranging from excellent to poor; the wording and response options are similar to the RAND-36 self-rated health item. Single-item measurement of quality of life is used extensively in health research.<sup>261</sup>

***Symptom Management Strategy.*** The SMT *Symptom Management Strategy* construct includes concepts for all aspects of an intervention. For the POWER Study the potential intervention was contact with multi-sensory nature outdoors. The "*How much?*" concept (see Figure 6.1) in this study referred to how much time older women usually spent outdoors. The survey included items about how many days during a usual week she went outdoors (days/week outdoors) and how long was she outside on a usual day (time/day outside). See Table 6.2 for the item examples. Women were asked to report the amounts of time they spent outdoors overall and in two specific (measured) outdoor spaces within each RC. In summary:

The time outdoors conditions were:

- Overall time outdoors
- Time spent (if any) in the space with a lower level of multi-sensory nature
- Time spent (if any) in the space with a higher level of multi-sensory nature

For each of these three conditions there were two measurements and one calculation:

- Days/week
- Time/day
- Estimated minutes/week = days/week X time/day

To calculate the estimated minutes/week outdoors the mid-points of the time/day categories were used to approximate minutes for each condition (e.g., mid-point of 'less than 15 minutes' was 7.5 minutes; mid-point of 'more than 1 hour' was 75 minutes). In order to address the Phase 2 aim (Aim three) a variable was constructed by subtracting the estimated minutes/week spent in the

space with a lower level of multi-sensory nature from the estimated minutes/week spent in the space with a higher level of nature (i.e., higher space estimated minutes/week - lower space estimated minutes/week = HL Difference).

**Survey summary and procedures.** Most items on the survey could be answered by placing a check mark in a box. Four open-ended items asked women about their preferences (in outdoor environments), activities, and their perception of how being outdoors influenced OA pain (or health in general, if the woman did not have OA).

Several items (AIMS2-SF, bodily pain, time outdoors) on the survey involved recalling experiences over the previous four weeks. The surveys were delivered within a one-week period at the end of September 2011. Concurrent distribution of surveys was intended to allow participants to answer the survey during the same time of year at all sites and when the previous four weeks were likely to include weather conditions that were neither especially hot nor cold. September is a month that typically has moderate temperatures and low rainfall amounts in the geographic region of the study sites. The National Weather Service Office report for this region for the month of September 2011 shows the average temperature was 64.0 degrees Fahrenheit (daily average range was 54.5 to 73.5).<sup>262</sup> There was some rain on eight days during this month (not including four days with a trace of rain). This means there were minimal weather-related barriers to women going outdoors during the time period of interest to the POWER Study.

### **Data Analysis**

The survey data were entered using Research Electronic Data Capture (REDCap)<sup>263</sup> tools hosted at the University of Washington. Data were then exported to SPSS version 18.0 (SPSS Inc., Chicago, IL) for management and statistical analysis. In all analyses, statistical significance was set *a priori* at a *p*-value of .05. Variable data were examined for overall distribution, errors,

and outliers using measures of central tendency, frequency distributions (histograms), and box-whisker diagrams. The written responses (to the four open-ended items) were entered directly into REDCap and exported into a separate document for content analysis at a future date.

**Sample characteristics.** Study variables were organized by SMT constructs of *Person* (demographics), *Health*, *Symptom Experience*, *Symptom Status and Outcomes*, and *Symptom Management Strategy* and then analyzed to determine if there were significant differences between women with and without OA using *t*-test or chi-square analyses, depending on variable level of measurement. In addition, the women living at the four different study sites were compared on selected variables to determine if there were significant differences across sites.

**Aim three.** The third aim of the POWER Study was to describe the extent to which the level of multi-sensory nature in outdoor spaces that women enter and person factors (OA, bodily pain, and functional status) are associated with time spent outdoors. The independent variables in this analysis were OA, bodily pain, and functional status. The dependent variables all involved the amount of time spent outdoors. First, a *t*-test was used to evaluate whether women with OA spent more time than women without OA in spaces with a higher level of nature. Then, because the spaces with higher and lower levels of multi-sensory nature were located within each study site, two-way fixed-effects analysis of variance (ANOVA) was used to examine, for women with and without OA, whether there was an interaction effect of site on time spent in the different spaces (i.e., the dependent variable is the HL difference). Then, the influence of a woman's bodily pain and functional status was examined, regardless of OA status, because pain and decreased functional status are highly correlated with OA. The continuous variables of bodily pain and functional status were divided into groups (approximate tertiles) of high, medium, and low for each measure. Each of the above analyses, using two-way fixed effects

ANOVA, was conducted separately to examine whether OA, bodily pain, or functional status was associated with time spent in the higher versus lower spaces, including interactions with site.

**Exploratory analyses.** The groups of women (with and without OA) were examined for differences in the number of days they went outdoors per week and the amount of time spent outside on days when they went outdoors. In addition, *t*-tests and ANOVA (as described above) of time spent outdoors overall (i.e., estimated minutes per week outdoors overall) were conducted .

## Results

Approximately 926 POWER Study surveys were delivered to women at the four RC study sites and 276 were returned, for an estimated overall response rate of just under 30%. The majority of the surveys (over 90%) were returned during the month of October 2011. The response rate showed variation by site; ranging from 15% to 44%. Approximately half of the surveys were returned to collection boxes at the sites, all others were returned by mail in preaddressed and stamped envelopes. Site administrators preferred not to use the collection boxes at one site, which was the site with the lowest return rate.

### Data Screening

Selected items and scales (comprised of multiple items) on the POWER Study survey data were examined for the percentage missing. The independent variables of OA status, bodily pain, and functional status each included data that were missing for multiple reasons, some which could be identified. The known reasons for missing data on OA status (total of 12.5%) included: neither yes or no was marked (OA status was missing) but the respondent checked joints (7.6%); no was checked, but the respondent also checked joints (2.8%); and other unclear responses, such as checking both yes and no (1.4%). In addition, some women skipped the item entirely (4.3%). A conservative decision was made to include only women who marked yes to

OA status as "with OA" and women who marked no as "without OA," as indicated above in the section on *Health*.

The items in the bodily pain scale (composed of two items) were seldom skipped (2.5% missing); in contrast many items were skipped on the AIMS-2SF. The AIMS2-SF scores were calculated in accordance with instructions from the tool developer regarding skipped items (F. Guillemin, PhD, email communication, September, 2012). The AIMS2-SF scales contain between 3 and 12 items. Scale scores were normalized to a range of 0 to 10 (with 0 being best health and 10 being worst) based on the mean of the item scores. If one or more items within a scale were skipped (but at least 50% of the items were completed), then the normalized score was calculated based on the mean of those items the participant answered. If the participant answered fewer than 50% of the items within a scale, then the score was considered missing. This approach decreased the percentage missing for the functional status score from 34% (the percentage of participants who skipped one or more items on this 12-item scale) to 4%. The two most frequently skipped items involved questions about the women's ability to drive a car or engage in vigorous activities.

The percentage of system-missing data (i.e., item was skipped) for the dependent variable of estimated minutes/week in a higher multi-sensory space was 9.1%, estimated minutes/week in a lower space was 10.9%, and overall estimated minutes/week was 4.1%. The variables of time spent outdoors in a higher or in a lower space were not normally distributed; the scores had a positive skew and a peak at zero. Square root transformation of these items was used to meet analytic assumptions for a normal distribution. A second HL Difference variable (sHL Difference) was calculated by first doing the square root transformation of the estimated minutes/week in a higher and lower space and then calculating the difference between the two

scores (i.e., square root of time in the higher space - square root of time in the lower space = sHL Difference).

### **Sample Characteristics**

The characteristics of study participants overall and by self-reported OA status are presented in Table 6.3. Women with and without OA were similar on all demographic variables and body mass index (BMI). For the characteristics related to *Health, Symptom Experience*, and *Symptom Status and Outcomes*, women with OA reported significantly greater difficulty (e.g., greater bodily pain, lower functional status) than women without OA. In addition, women with OA reported use of pain medication more than twice as often as those without OA.

**Table 6.3. Sample Characteristics by Osteoarthritis Status**

	<b>Total Sample Mean or % N= 276</b>	<b>Women with OA <sup>a</sup> Mean or % n=113</b>	<b>Women without OA Mean or % n= 118</b>	<b>p-Value <sup>b</sup></b>
<b><i>Person (demographics)</i></b>				
Age (years)	81.7	81.8	81.2	.56
Partner status (single)	75.2%	77.3%	73.1%	.46
Income (higher)	59.8%	55.8%	63.5%	.23
Education (college degree or higher)	61.0%	59.6%	67.0%	.26
Race (Caucasian)	89.5%	89.3%	89.4%	.91
<b><i>Health</i></b>				
OA status (self-report of OA diagnosis)	48.9%	100%	0%	
Self-rated health	2.5	2.7	2.3	.001
BMI	26.1	26.5	25.7	.289
<b><i>Symptom Experience</i></b>				
Bodily pain <sup>c</sup>	63.3	56.1	73.2	<.001
Use of pain medication	63%	83.6%	39.7%	<.001
<b><i>Symptom Status and Outcomes</i></b>				
Symptom (arthritis specific)	2.3	3.3	1.0	<.001
Functional status	2.1	2.4	1.6	<.001
Emotional status	2.6	2.7	2.1	.002
Co-morbidities	2.0	2.7	1.2	<.001
Quality of life	2.4	2.5	2.3	.018

**Note.** Table is organized by Symptom Management Theory construct. <sup>a</sup> OA = osteoarthritis.

<sup>b</sup>t test or chi-square (depending on level of measurement) comparing women with/without OA.

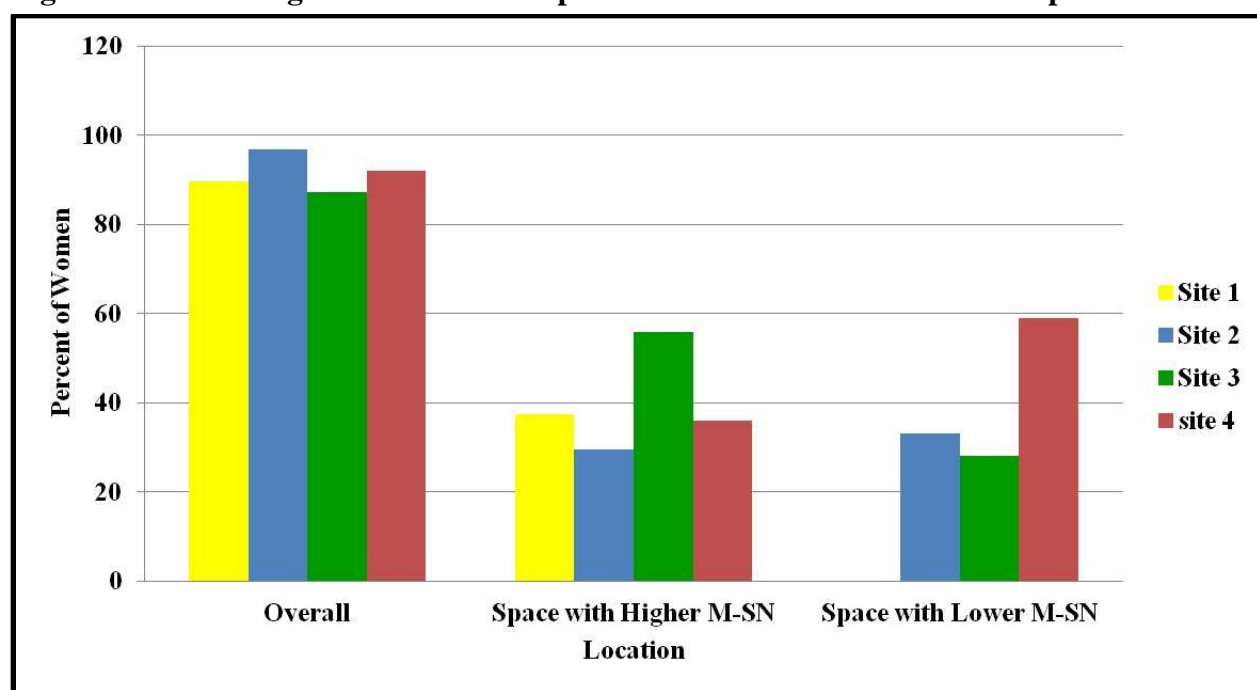
<sup>c</sup>Lower score = more severe pain.

Women with OA reported spending fewer days outdoors each week than women without OA. However, on days when women with OA went outdoors they spend a similar amount of time outside as women without OA. Examination of the overall estimated minutes outdoors per week (days/week X time/day) showed a significant difference in the overall amount of time that women with OA spent outdoors each week compared to women without OA.

Sample characteristics were also compared by RC study site and showed that the independent variable OA status was not significantly different ( $p=.67$ ) among the four sites.

However, several other variables did show significant differences, including age ( $p < .001$ ), income ( $p < .001$ ), race ( $p = .01$ ), and number of co-morbidities ( $p = .03$ ). For the dependent variables, overall time outdoors was not significantly different among the sites ( $p = .34$ ); however, time spent in both the higher ( $p < .001$ ) and lower ( $p < .001$ ) multi-sensory spaces was significantly different among the sites. The similarity in time spent outdoors overall and differences in time spent in the higher and lower spaces are presented in Figure 6.1.

**Figure 6.1. Percentage of Women who Spend at Least 30 Minutes Outdoors per Week**

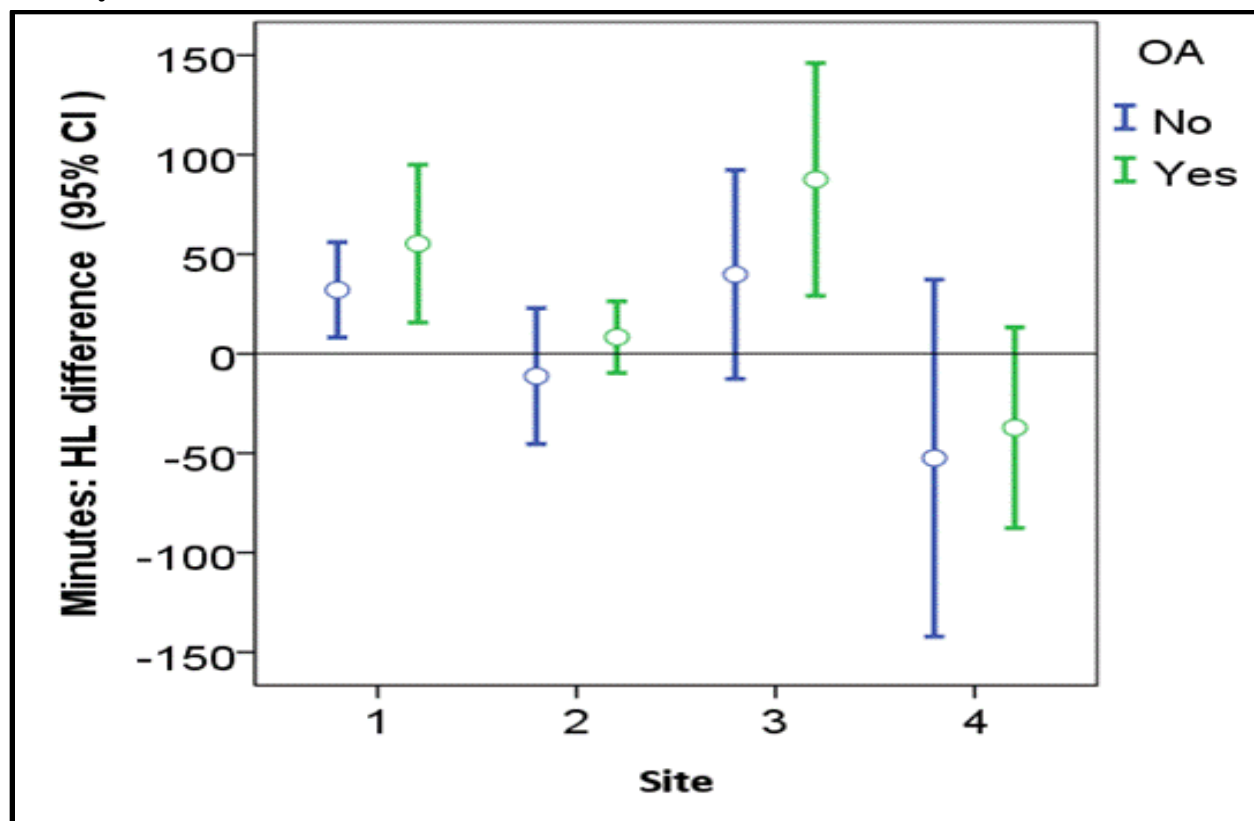


**Note.** Women who reported spending less than 30 minutes outdoors per week are not included in totals on this graph. Bar colors indicate the study site; at site 1 no women reported spending 30 minutes or more in the space with lower level of multi-sensory Nature (M-SN).

### Aim 3: Time Spent Outdoors by Women with and without OA

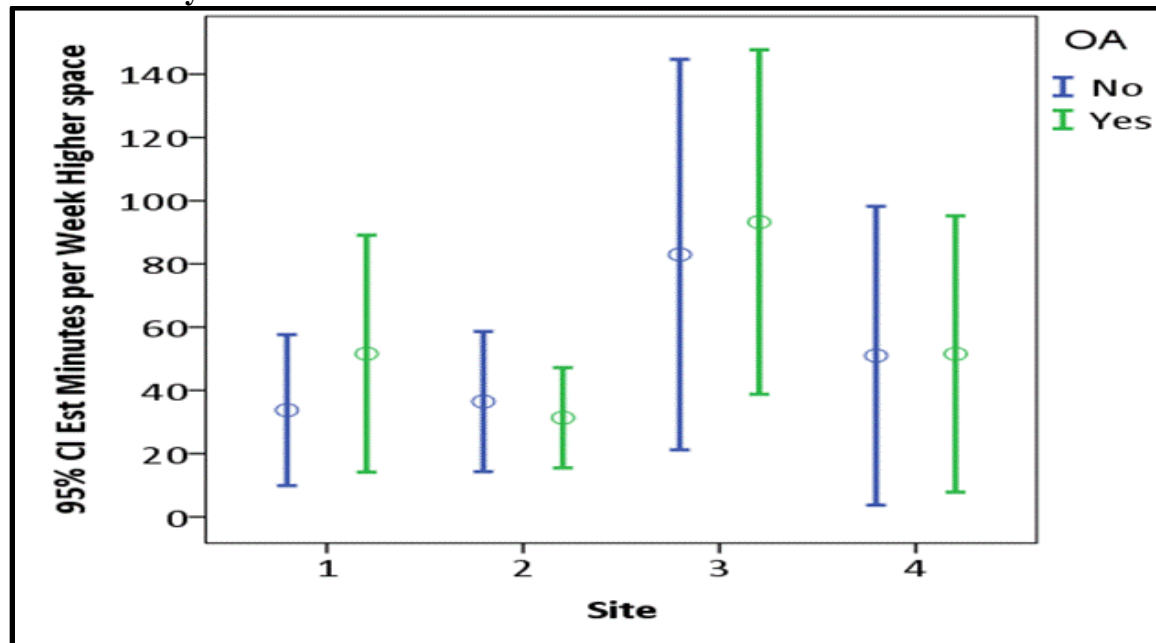
Based on the *t*-test analysis of women with and without OA there was no difference ( $p=.21$ ) in the amount of time women spent in spaces with a higher versus lower level of multi-sensory nature. Figures 6.2, 6.3, and 6.4 present the mean amounts of time women (with and without OA) spent in outdoor spaces with higher and lower levels of multi-sensory nature, by RC study site, in terms of the HL difference, time in a higher level space, and time in a lower level space respectively. A description of the HL Difference variable can be found in the Methods section under Measures - *Symptom Management Strategy*. Note that data are represented as time in minutes for these figures, rather than their square root transformation.

**Figure 6.2. Time Spent in Outdoor Spaces with a Higher versus Lower Level of Multi-sensory Nature**



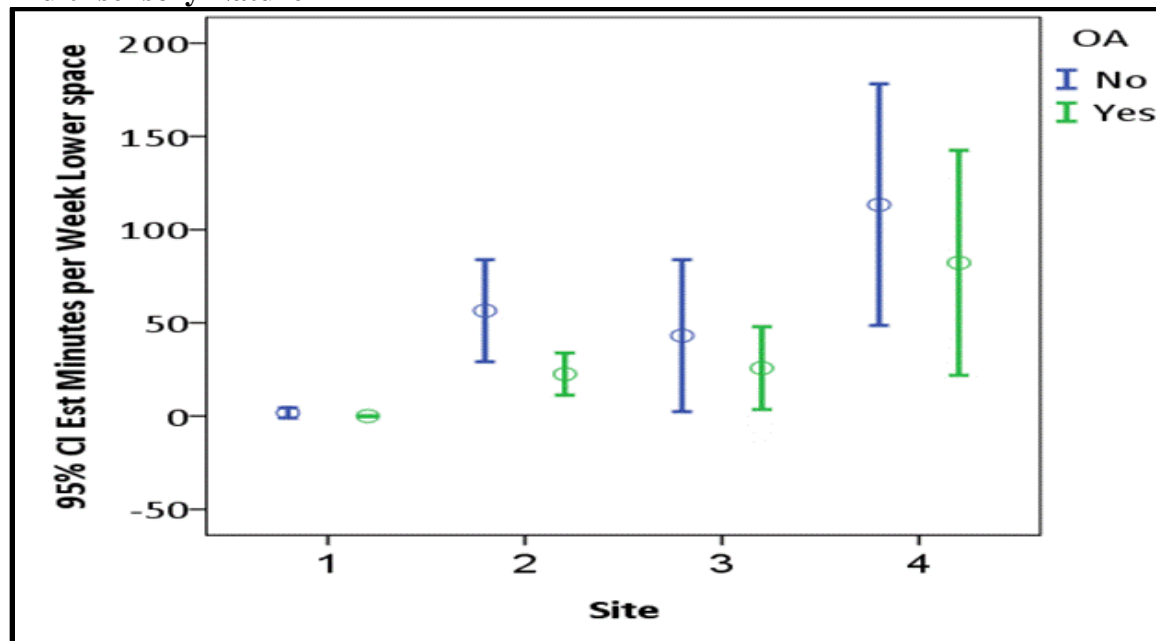
**Note.** HL difference = Time spent in outdoor space with a higher level of multi-sensory nature (M-SN) minus time spent in a lower level space. The horizontal line separates time spent in a space with higher (above the line) versus lower (below the line) level of M-SN. CI = confidence interval; OA = osteoarthritis.

**Figure 6.3 Time Spent in Retirement Community Outdoor Spaces with a Higher Level of Multi-sensory Nature**



**Note.** Average time spent in an outdoor space with a higher level of multi-sensory nature by women with/without osteoarthritis by retirement community sites. CI = confidence interval; Est = estimated; OA = osteoarthritis.

**Figure 6.4 Time Spent in Retirement Community Outdoor Spaces with a Lower Level of Multi-sensory Nature**



**Note.** Average time spent in an outdoor space with a lower level of multi-sensory nature by women with/without osteoarthritis by retirement community sites. CI = confidence interval; Est = estimated; OA = osteoarthritis.

The overlapping confidence intervals in Figure 6.2 demonstrate that within each site, and across sites, there were no differences between women with and without OA in terms of the amount of time spent in spaces with higher versus lower multi-sensory nature. Figures 6.2, 6.3, and 6.4 show the influence of study site on time spent in an outdoor space regardless of a woman's OA status.

**Table 6.4. Score Ranges for Bodily Pain and Functional Status Groups**

<ul style="list-style-type: none"> <li>○ Bodily pain (range of 0 to 100 with most severe pain level = 0)           <ul style="list-style-type: none"> <li>▪ Mild or no pain (score = 80 or above)</li> <li>▪ Mid-range pain (score from 50 to 77.5)</li> <li>▪ Most severe pain (score = 47.5 or below)</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>○ Functional status (range of 0 to 10 with worst functional status = 10)           <ul style="list-style-type: none"> <li>▪ Best functional status (score = 1.00 or below)</li> <li>▪ Mid-range functional status (score from 1.04 to 2.50)</li> <li>▪ Worst functional status (score = 2.75 or above).</li> </ul> </li> </ul>

**Note.** To conduct analysis of variance to examine the influence of bodily pain and functional status, the scores on these two variables were grouped to include approximately similar number of participants (tertiles).

The results for the two-way fixed-effects ANOVA for the person factors of OA status, bodily pain group, and functional status group are reported in Table 6.5 (with score ranges for bodily pain and functional status groups in Table 6.4). The ANOVAs for each person factor were tested separately. Regardless of a woman's OA status, bodily pain level, or functional status level, there was no difference in the amount of time a woman spent in outdoor spaces with different levels of multi-sensory nature. Among the four RC study sites, however, the amount of time spent in an outdoor space with a higher versus a lower level of multi-sensory nature was significantly different. There was no significant interaction effect on time spent in the higher versus lower spaces between any person factor and the RC study sites. These findings show that

site has the most impact on the amount of time that a woman spends in an outdoor space and not the level of multi-sensory nature level for that space.

**Table. 6.5. Analysis of Variance for Time Spent in Space with Higher versus Lower Level of Multi-sensory Nature**

Source of Variation	F(df) <sup>c</sup>	<i>p</i> -Value
OA <sup>b</sup> status	2.63 (1,179)	.12
RC <sup>c</sup> study site	10.32 (3,179)	<.001
OA X Site	.17 (3,179)	.92
Bodily pain group	2.37 (2,202)	.10
RC study site	12.09 (3,202)	<.001
Bodily pain X Site	1.51 (6,202)	.18
Functional status group	.47 (2,199)	.63
RC study site	12.46 (3,199)	<.001
Function status X Site	1.57 (6,199)	.16

**Note.** Two-way fixed effects analysis of variance with each person factor tested separately to examine difference in the amount of time spent in outdoor spaces with higher versus lower level of multi-sensory nature (M-SN). <sup>a</sup>F = F ratio; df = degrees of freedom for the particular factor and error, <sup>b</sup>OA = Osteoarthritis, <sup>c</sup>RC = Retirement community.

### Exploratory Analyses

The exploratory analyses considered separately the number of days women went outdoors per week, the amount of time they spent outside on a usual day, and the overall time spent outdoors (within and outside of their RC) by OA status. Based on the *t*-test analyses, women with OA reported going outdoors on a significantly fewer number of days per week ( $p=.005$ ), but there was not a significant difference in the amount of time they spent outside on days when they did go outdoors ( $p = 0.46$ ). The overall amount of time women with and without OA reported going outdoors per week (estimated minutes outdoors overall) was significantly different ( $p=.01$ ).

The results for the two-way fixed-effects ANOVAs for the person factors of OA status, bodily pain group, and functional status group, based on the overall amount of reported time spent outdoors per week are shown in Table 6.6. Time spent outdoors overall was significantly different by OA status ( $p=.03$ ), bodily pain level ( $p=.001$ ), and functional status level ( $p<.001$ ). Only the bodily pain level showed a significant difference by RC study site ( $p=.04$ ). There was no significant interaction between any person factor and RC study site. Post hoc comparisons of bodily pain levels using the Scheffé test showed that there was a significant difference between the group with the most severe level of pain and the lowest level of pain ( $p<.001$ ). The group with the most severe pain spent significantly less time outdoors. However, there was not a significant difference between the group with the mid-range level of pain and either the most severe or lower level groups. Post hoc analysis for functional status levels showed significant differences between the women with the worst functional status and women in both other groups; mid-range functional status ( $p<.001$ ) and best functional status ( $p<.001$ ). The women with best functional status spent significantly more time outdoors than the women with the mid-range functional status and these women spent significantly more time outdoors than the women with the worst functional status.

**Table. 6.6. Analysis of Variance for Overall Time Spent Outdoors**

<b>Variable - Overall Time Outdoors</b>	<b>F(df)<sup>a</sup></b>	<b>p-Value</b>
<b>OA<sup>b</sup> status</b>	4.73 (1, 216)	.03
<b>RC<sup>c</sup> Site</b>	1.72 (3,216)	.16
<b>OA status X site</b>	.84 (3,216)	.47
<b>Bodily pain group</b>	7.63 (2,247)	.001
<b>RC Site</b>	2.78 (3,247)	.04
<b>BP group X Site</b>	.93 (6,247)	.47
<b>Functional status group</b>	21.62 (2,239)	<.001
<b>RC Site</b>	.44 (3,239)	.73
<b>Function status X site</b>	.93	.48

**Note.** Two-way fixed effects analysis of variance with each person factor tested separately to examine difference in the amount of time spent in outdoor spaces <sup>a</sup>F = F ratio; df = degrees of freedom for the particular factor and error, <sup>b</sup>OA = Osteoarthritis, <sup>c</sup>RC = Retirement community.

### **Discussion**

Phase 2 of the POWER Study focused on the association between a specific health condition (OA) and a measured level of multi-sensory nature in outdoor spaces. In contrast to other studies of outdoor built environments and health, which have primarily examined physical activity or walking in a neighborhood,<sup>144, 192</sup> the POWER Study focused on the symptom of pain and on a detailed measurement of nature in a small and well-defined retirement community space. The POWER Study participants were, on average, older (with a mean age of 82 years) compared to two other recent studies of older adults in outdoor environments, one regarding those with OA (mean age 70 years)<sup>144</sup> and one regarding those with mobility disabilities (mean age 67 years).<sup>264</sup> These two other studies included only individuals with the health condition of interest, in contrast to the POWER Study, which compared women with and without OA.

The POWER Study findings suggested no association between the level of multi-sensory nature in an outdoor space and the amount of time spent in the space by women with and without OA. The women participating in the POWER Study lived within RCs that provided access to outdoor spaces with a higher and a lower level of nature. For these women, the time they spent in one outdoor space compared to another was most strongly associated with the RC study site and not with the health condition (i.e., whether or not the women had OA, or greater bodily pain; or a lower functional status).

An important consideration is that measured differences were not very large between the lower and higher levels of multi-sensory nature in the spaces being compared. The ANOET-R Multi-sensory Nature dimension has a range of 0 to 10;<sup>217</sup> spaces with the higher level had a score of 6 and spaces with the lower level had a score of 4. It is possible that all of the spaces (within the different sites) had a sufficient or threshold amount of multi-sensory nature to provide enough opportunities for engaging the attention of women with OA pain. It may be that greater differences in level of multi-sensory nature would be needed to determine whether the level of multi-sensory nature has an effect on time spent outdoors among older women with OA pain. As a preliminary investigation into a new field of inquiry, the POWER Study did not use an *a priori* power analysis to determine the sample size needed to avoid a Type II error. However, if a moderate effect size of .50 were assumed, the sample size needed for each group would have been  $n = 63$  in order to have less than 20% chance (or  $\beta \geq 80\%$ ) of incorrectly finding no difference between groups.<sup>265</sup> While the sample size in the POWER Study exceeded this number, further study is warranted to estimate effect sizes and increase the distinction between the environmental conditions of higher versus lower multi-sensory stimuli of nature.

Further examination of the environment data collected from the study sites is needed to explore other differences between these outdoor spaces. A more in-depth consideration of the six other ANOET dimensions<sup>216</sup> (i.e., dimensions other than Contact with Nature) may provide additional insight into spaces that were used for greater or lesser amounts of time. Also of note is that there were different types of outdoor spaces. Some of the spaces were terraces, while others were on ground level; type of space may make a difference in women's use of the space. Importantly, there were no data collected regarding programs or regular uses of the space by residents in these RCs in general. The *Cultural* (policies or programming of the RC) and *Social* (friends, family, and other RC residents) aspects of the *Environment* for these outdoor spaces (as SMT would indicate) need to be included in future examination of whether the level of multi-sensory nature makes a difference in time spent in an outdoor space by older women with OA.

The method of measuring OA pain is also a consideration when interpreting the findings of the POWER Study. It is of note that women with OA in any joint were included in the study. Research on OA often includes only participants who have OA in a specific joint (most frequently knee OA).<sup>64</sup> Consequently, many OA-specific instruments have been developed for knee (or knee and hip) OA.<sup>266, 267</sup> The RAND 36 bodily pain scale<sup>255</sup> (2 items) and the symptom status scale from the AIMS2-SF<sup>257</sup> (3 items) were selected for the POWER study, because both instruments were valid for measuring pain without regard to specific joints. However, the selection of these tools provided only limited measurement of OA pain. One consideration for future research in this area is to use an instrument that would provide more in-depth information regarding OA pain, such as the Intermittent and Constant Osteoarthritis Pain measure.<sup>267</sup>

The findings of the exploratory analyses raise several intriguing questions that are worthwhile to pursue in future research. It is important to replicate certain elements of the

POWER Study in order to determine if women with OA are outside for a similar amount of time as women without OA on a day when they go outdoors; and if women with OA go outdoors on fewer days per week than women without OA. If this finding is confirmed, then it may be worthwhile to consider other factors (e.g., having a pet) that might influence whether or not women with OA go outside.

This study had several limitations. The diagnosis of OA was by self-report only; though self-report is a commonly used measure of OA status.<sup>64</sup> The 30% response rate of the POWER Study survey was low in comparison to 52%<sup>268</sup> and 84%.<sup>269</sup> response rates in other studies using similar methods (i.e., self-administered survey of older adults living within RCs). The lower response rate raises concerns about unmeasured differences between women who did and did not respond. For example, women with OA in finger joints may have found a paper and pen survey too painful to complete. There were many skipped items on the surveys; most importantly, the AIMS2-SF Physical items were often skipped. Considerations for future work in this area include limiting the number of items on the survey and the use of interview survey methods. However, as an initial inquiry into the question of time spent outdoors in specific spaces by older women with OA, this was an efficient method of addressing the study aim.

### **Conclusion**

The POWER Study Phase 2 findings demonstrated the strong influence of RC site (as opposed to level of multi-sensory nature) on the use of outdoor spaces within each community. The exploratory analyses showed that OA, bodily pain, and functional status can all impact the overall amount of time that an older woman spends outdoors. Spending less time outdoors may decrease opportunities for a woman to be in environments that provide contact with nature that can potentially provide distraction from pain.

Future exploratory analyses of the POWER Study (Phase 2) data including grouping variables by SMT constructs, will contribute to adapting the SMT to a situation-specific model. This research will help to guide future testing of environment-based interventions for OA pain management. The SMT conceptual framework supported this initial inquiry into the influence of environment on OA pain; future study should include the cultural and social elements of environment to gain a greater understanding of the possibilities for environmentally-based pain management interventions.

## Chapter 7

### BUILDING A SITUATION-SPECIFIC MODEL

The Pain of Osteoarthritis in Women: Environment Research (POWER) Study was designed to inform future research on pain management interventions that use nature to provide distraction from osteoarthritis (OA) pain. The POWER Study used Symptom Management Theory (SMT; see Figure 2.1)<sup>28</sup> constructs to examine the symptom management process of OA pain. These management process constructs are *Symptom Experience*, *Symptom Management Strategy*, and *Symptom Status and Outcomes*. *Symptom Experience* was examined to better understand the *Perception, Evaluation, and Response* of women who experience OA pain in regard to their time spent outdoors. *Symptom Management Strategy* was examined by measuring the level of multi-sensory nature in outdoor spaces and comparing the amount of time women (with and without OA) spent in spaces with different levels of multi-sensory nature. Concepts related to *Symptom Status and Outcomes* were measured to explore associations among the SMT symptom process constructs.

The fourth aim of the POWER Study was to integrate qualitative and quantitative findings to develop a situation-specific model regarding older women with OA. While SMT provides overall guidance for studying symptom management interventions, a conceptual model that is focused more narrowly is needed to study a specific symptom (pain) in regard to a particular condition (OA) for a target population (older women). This chapter brings together findings from all phases of the POWER Study. The background section places the POWER Study findings within the context of nursing theory. The methods section describes the process used to integrate the findings from different phases of the POWER Study into a situation-specific model. The results section presents this model (based on and derived from SMT) that brings into

focus the POWER study findings. Discussion of these findings includes hypotheses that may be tested in future research. As the last chapter of the dissertation, the conclusion section addresses the dissertation study overall (rather than focusing on the fourth aim and this chapter).

### **Background**

Nursing scientists often refer to three levels of theory: grand, middle range and situation-specific.<sup>270, 271</sup> The different levels of theory vary in their degree of abstraction with grand theory, as the most abstract, providing an overarching view of the field of nursing. Situation-specific theory is the least abstract and focuses on particular patient groups and circumstances.<sup>270</sup> Middle range theory, with a more narrow scope than grand and a broader focus than situation-specific, is often used to develop the conceptual framework of a research study.

Theories within each of these levels also vary by degree of abstraction, breadth, and depth. Given its central focus on symptoms, SMT is not a grand theory, but it is a middle range theory<sup>28</sup> of the highest degree. SMT focuses on a primary concern of nursing practice (symptom management) and places this concern into the broadest possible context within the core nursing domains of health, person, and environment.<sup>6</sup> In addition to being a middle range theory, SMT is also an ecological model.<sup>272</sup> Ecological models situate the person within an environmental context that has multiple levels.<sup>273</sup> Thus, SMT provides a frame of reference with which to study the influence of environmental characteristics (i.e. design features), such as the type of nature, on OA pain in older women.

Nursing theories also vary in the extent to which there is connection or congruence with other theories. SMT is most closely linked to Orem's Self-Care Deficit theory,<sup>28, 35</sup> which is a well-established grand theory of nursing science.<sup>36</sup> However, the emphasis of SMT on environment differentiates it from Orem's theory, particularly the explicit inclusion in SMT of

the physical environment. In fact SMT's multi-level definition of environment not only places it into the broader context of an ecological model, but also supports its congruence with theories based in other disciplines (in particular, public health and environmental psychology).<sup>23, 149</sup> This congruence in theory provides an underlying conceptual structure that promotes interdisciplinary research efforts.

Situation-specific theory (as opposed to grand or middle range theories) focuses attention on discrete circumstances that involve not only a particular health problem and population, but also the social and historical conditions associated with that health problem.<sup>270</sup> Although a situation-specific theory may directly relate to or be derived from a grand or middle range theory, this level of theory uses a "human justice and equity framework" with the goal of achieving a narrowly focused theory.<sup>274</sup> In contrast, a situation-specific model is not a situation-specific theory, but a conceptual framework for research focused on a particular health problem and population.

SMT is comprehensive, and it is therefore complex. The complexity of SMT makes it difficult to address the entire theory within one study.<sup>28</sup> Some researchers have handled the complexity of SMT by using some elements of SMT and, in the same study, using a second theory or model.<sup>275, 276</sup> However, this effort can lead to even greater complexity, as the conceptual frameworks may not be congruent. A more efficient approach has been proposed, to use a series of studies that examine different aspects of SMT.<sup>28</sup> SMT was developed through a similar process (i.e., it was based on symptom intervention studies conducted by the SMT developers),<sup>6</sup> which contributed to its progression from a model<sup>27</sup> to a theory.<sup>28</sup>

Critiques of SMT have been published including one that compares four models or theories of symptom management<sup>33</sup> and another that is an analysis of SMT, specifically.<sup>277</sup> Both

of these critiques suggest that there are two major gaps in the theory. One gap is the lack of a time component; although this gap could also be interpreted as the absence of restriction or assumptions about time. This characteristic of the theory may facilitate use of SMT in circumstances involving either acute or chronic conditions.<sup>28</sup> The second identified gap is the lack of guidance on symptom clusters; however, several research publications addressing multiple symptoms have used SMT as a conceptual framework.<sup>30, 32, 278</sup> In the most recent presentation of SMT (written by the researchers who developed it),<sup>28</sup> extension and refinement of SMT is encouraged.

Although there are over 35 publications on the use of SMT in research,<sup>28</sup> including several studies involving pain,<sup>279-281</sup> none were found regarding musculoskeletal pain in older adults. Consequently, the POWER Study cast a broad net in its aims and methods (using the conceptual framework provided by SMT) to identify the factors most relevant to older women with OA. The design of the POWER Study was also guided by a review of the literature and consultation with experts. In summary, the ultimate goal of the POWER Study was to provide a foundation for further work by developing a preliminary situation-specific model to be tested in future research.

## **Methods**

### **Overview**

An integration of the findings from all phases of the POWER Study contributed elements that informed a situation-specific model derived from the SMT constructs and their predicted dynamic bi-directional relationships. SMT provided the conceptual framework for the data collection plan during each phase of the POWER Study; consequently, the findings from each phase of the study were aligned with specific concepts within the SMT constructs (see Table

7.1). Although SMT provided the constructs and predicted relationships, the specific symptom (pain), particular health condition (OA), and target population (older women) guided refinement of SMT into a more focused situation-specific model. The particular concepts related to this specific situation were then linked to the intervention of interest (contact with nature in outdoor environment spaces).

**Table 7.1. Study Phase and Symptom Management Theory (SMT) Constructs**

<b>Data Collection Phase</b>	<b>SMT Construct</b>
<b>Preliminary Phase</b>	<i>Environment: Physical</i>
<b>Phase 1</b>	<i>Symptom Experience: Perception, Evaluation, Response</i> <i>Symptom Management Strategy: Where?</i>
<b>Phase 2</b>	<i>Person: Demographics</i> <i>Health: Osteoarthritis status</i> <i>Symptom Status and Outcomes: bodily pain, Functional Status</i> <i>Symptom Management Strategy: How much time is spent outdoors? Where?</i>

**Note.** SMT constructs and concepts are in *italics* to indicate their specialized meaning as defined by the theory developers.<sup>6, 27, 28</sup> Concepts within these constructs are presented in the form: *Construct: Concept*. Words that are not italicized are concepts specific to this study.

### **Methodological Approach**

Triangulation is a term that is often used to describe the combining of findings from qualitative and quantitative methods to achieve greater confirmation of study results.<sup>265</sup> Theory can support the process of triangulation to help bring together and make meaning of findings that are derived from different methodological approaches.<sup>282</sup> The POWER Study did not use either triangulation or theory to confirm findings; instead theory provided a conceptual framework to guide the building of a model.

More than one methodological approach was used in the POWER Study because SMT constructs have conceptual definitions that suggest the need for information from both quantitative and qualitative sources. The *Symptom Experience* construct extends beyond

perception of a sensation to include also its evaluation and response; therefore, this highly individualized experience can be challenging to quantify. Conversely, *Symptom Management Strategy* and *Symptom Status and Outcomes* include concepts with characteristics that may be measured objectively and thereby quantified. Thus, information gained from different methodological approaches informed different constructs of SMT and were integrated to build a conceptual model relevant to the target population and circumstances.<sup>283</sup>

The findings previously presented in Chapters 5 and 6 of this dissertation were used to inform the development of a new model, along with one additional finding on self-management of symptoms. This additional finding is an expanded qualitative content analysis (the methods related to this finding can be found in Chapter 5). Although beyond the scope of the POWER Study specific aims (particularly Aims 1 and 2), the finding is included here as it makes an important contribution to the situation-specific model.

## **Results**

The results are presented in two sections. First, the finding from the expanded qualitative content analysis - related to self-management of OA pain symptoms - is presented. The development of the situation-specific model, informed by the qualitative and quantitative findings of the POWER Study, is then described. The SMT diagram<sup>6</sup> (the same graphic figure, previously shown in Figure 2.1) is presented as a review of the original configuration. This diagram is followed by two new diagrams 1) the situation-specific model representing a refinement of SMT and using the SMT constructs and 2) the situation-specific model incorporating the findings from the POWER Study that were used to inform potential relationships among SMT concepts.

## Symptom Management Theory: Self-management Concepts

The information presented here is based on the interview data (Phase 1) that were analyzed using a qualitative method called directed content analysis (DCA; described in Chapter 5). Conducting DCA involves clarifying construct and concept definitions (in order to code the meaning units with the predetermined categories of the theory). Self-management concepts are conceivably within all three constructs of the symptom management process: 1) *Symptom Experience: Response*, 2) *Symptom Management Strategy: Who delivers*, and 3) *Symptom Outcome: Self-care*. The quotations below provide examples of interview text that was coded into these concepts within the construct categories (underlined portion highlights relevant text):

### 1) *Symptom Experience: Response to Symptoms*

*"Well, I suppose I'd come home and take half a pill or full pill, and just stay home."*

### 2) *Symptom Outcomes: Self-care*

*"Walking and exercising at the same time helped me so much and just made me feel better all over, which you might not think that would help, but it did, and I came in feeling refreshed and my limbs felt better and muscles felt better and I slept better."*

### 3) *Symptom Management Strategies: Who delivers*

*"...within about 15 minutes I will always stand up and walk and use them so I don't get any pain in my hip. It's just the movement that it needs to keep it from pain."*

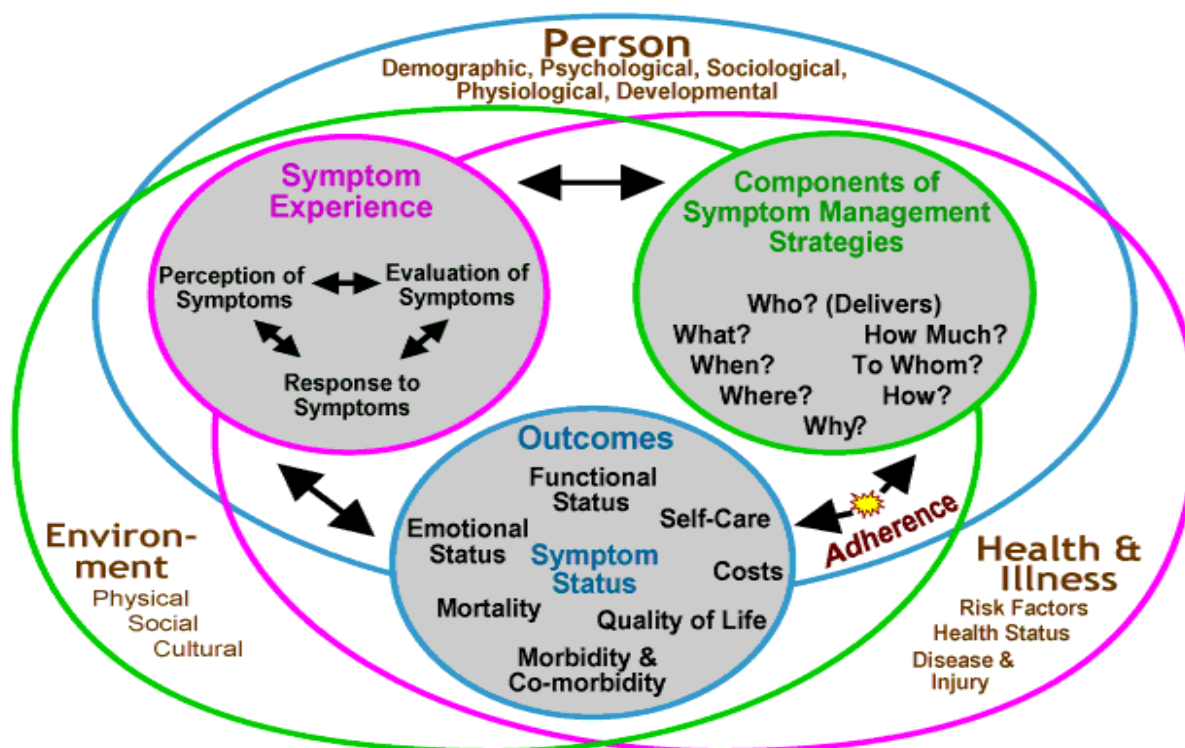
POWER Study participants interviewed during Phase 1 of the study had years of symptom experiences to which they were responding. Participants responded to OA pain in a variety of ways that were spontaneous, habitual, or planned. The spontaneous or habitual (i.e., not planned) responses could be logically categorized as *Symptom Experience: Response*. However, the routines of self-care, such as regularly walking outdoors, might be *Symptom*

*Outcome: Self-care* or even categorized with other planned routines (that more specifically address joint pain) carried out by the woman herself that are placed within the *Symptom Management Strategy* category. Consequently, the situation-specific model has the concept 'Self-care' in the *Symptom Management Strategy* construct.

#### Aim 4: A Situation-specific Model of Symptom Management Theory

The original SMT diagram (Figure 7.1, which duplicates Figure 2.1) provided a graphic presentation of the major constructs and concepts of the theory. The major constructs are the domains of nursing science (*Health, Person, and Environment*) and the dimensions of the symptom management process. This diagram is included here (as well as in chapter 2) to facilitate comparison with the new situation-specific model in Figure 7.2

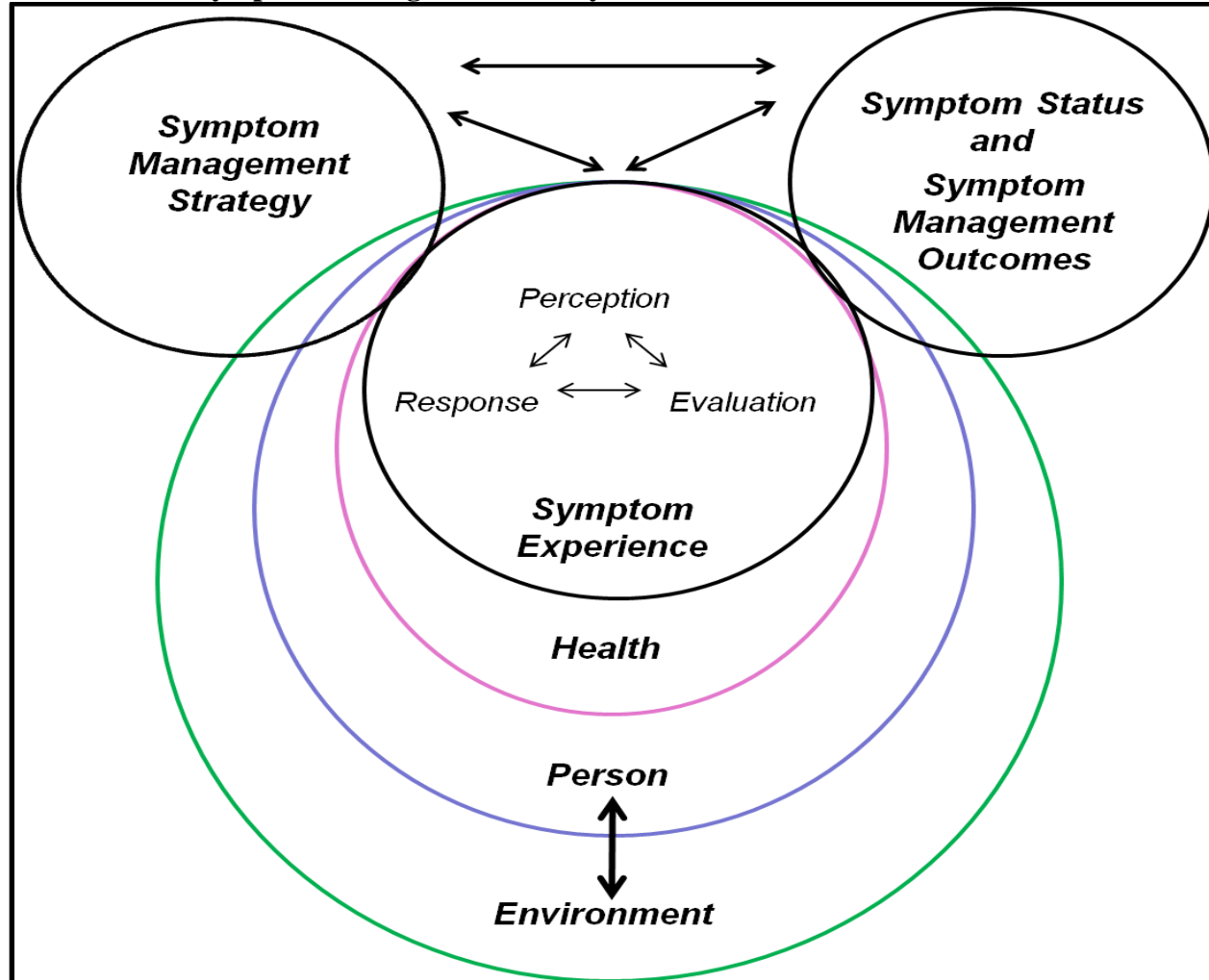
**Figure 7.1. Symptom Management Model** <sup>6</sup>



**Note.** Copyright (2001) Wiley. Used with permission from Dodd M, Janson S, Facione N, et al. Advancing the science of symptom management. *Journal of Advanced Nursing*, March 2001. This diagram is the graphic representation of Symptom Management Theory.<sup>28</sup>

The refinement of SMT into a situation-specific model (Figure 7.2) retains the major constructs of the theory. However, similar to the diagram in Chapter 5 (Figure 5.2), the *Person* domain is within *Environment*. In the situation-specific model (Figure 7.2), a thick arrow emphasizes the relationship (predicted by SMT) between Person and Environment. This arrow is intended to show that Person-Environment Relation warrants particular attention when considering an environment-based intervention for older women with OA pain. The domain of *Health* is placed within the *Person* domain because in the POWER Study all health information was provided by self-report and is therefore the subjective representation of the women's health (as opposed to objective measures by health care professionals). The circle representing *Symptom Experience* is now fully located within the *Health* domain, as it is associated with the disease of OA (and because *Health* is placed fully within *Person*). *Symptom Management Strategy* and *Symptom Status and Outcomes* are placed above the rest of the model due primarily to space considerations, but both overlap all three domains (*Person*, *Health*, and *Environment*). The overlap conveys that all three domains may potentially influence and/or involve both constructs (*Symptom Management Strategy* and *Symptom Status and Outcomes*). The situation-specific model retains the bi-directional arrows depicting the relationships among the symptom management process constructs.

**Figure 7.2. Overview of the Situation-specific Model:  
Derived from Symptom Management Theory**

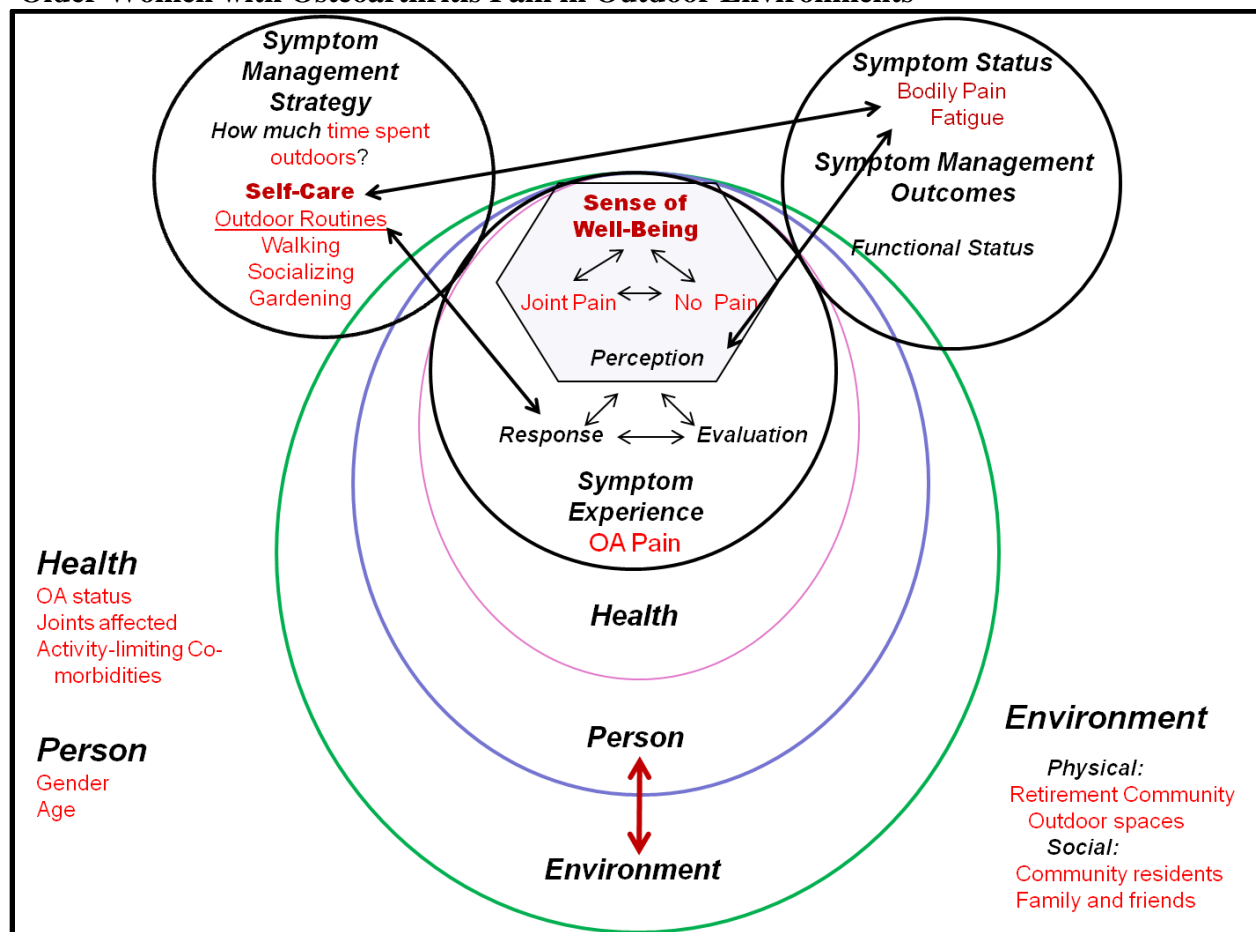


**Note.** This figure is derived from the graphic representation of the Symptom Management Theory (SMT).<sup>6</sup> SMT nursing domain constructs are presented as concentric (rather than overlapping). The symptom management process constructs are retained, but put into new positions relative to the domain constructs. The Person-Environment relation construct (implied in SMT) is made explicit with a bi-directional arrow. With the exception of the *Symptom Experience* concepts and the Person-Environment Relation arrow, only the major constructs of SMT are presented in this model.

This revised SMT diagram supports the graphic depiction of the POWER Study findings presented in Figure 7.3 (below). In Figures 7.2 and 7.3 the original SMT constructs and concepts are italicized and are also in bold print. In Figure 7.3 POWER Study concepts that have been

added to the model are in red; concepts within the domains (*Health, Person, and Environment*) are identified beside the model due to space considerations.

**Figure 7.3. Situation-specific Model:  
Older Women with Osteoarthritis Pain in Outdoor Environments**



**Note.** This diagram incorporates the POWER Study findings into the situation-specific model.

In the situation-specific model the concept of *Symptom Experience: Perception* is elaborated (as in Chapter 5, Figure 5.2) and *Perception* is contained within a shape highlighted in blue. 'Sense of Well Being' as a component of *Symptom Experience: Perception* is a finding discussed in Chapter 5. The POWER Study findings of OA pain in outdoor environments (i.e., *Symptom Experience: Perception*) included this array of experiences (joint pain - no pain - sense of well-being). The term 'Self-care' was originally in the *Symptom Status and Outcomes*

construct, but it is now in the *Symptom Management Strategy*, as described above. In the POWER Study 'Self-care' often involved descriptions of routines that included walking, socializing, or gardening (because the interviews involved outdoor experiences). However, it is of note that this refinement leaves a gap not addressed in this situation-specific model, because the original concept (of *Self-care*) has been retained.

The quantitative findings from Aim 3 (Chapter 6) are depicted in the construct of *Symptom Status and Outcomes* as a proposed symptom cluster of bodily pain and fatigue. Additionally, these quantitative findings are represented in the *Symptom Management Strategy: How much* concept, as well as the *Health* and *Person* domains. The situation-specific model continues to use the bi-directional arrows among the symptom management process constructs that are part of the original SMT.<sup>6</sup> However, the arrows are now targeted more directly at concepts within the constructs, reflecting particular relationships identified in the POWER Study. Specifically, *Symptom Experience: Perception* has a direct relationship with the *Symptom Status* of bodily pain. Fatigue is included in this model as a symptom associated with persistent pain. Sleep disturbance was mentioned by women in the interviews (Chapter 5) and measured indirectly with an item regarding the extent to which arthritis pain has affected sleep on the Symptom scale within the Arthritis Impact Measure 2 Short Form (Chapter 6). *Symptom Experience: Response* is predicted (by SMT) to have a bi-directional relationship with *Symptom Management Strategy* suggesting that *Self-Care* strategies that began as a *Response*, may evolve over time into more planned strategies. The bi-directional arrow between *Self-care* and *Symptom Status* indicates the potential influence on bodily pain and fatigue of specific *Self-care* routines that occur in outdoor environments. Finally, the bi-directional arrow between *Person* and *Environment* (the PE-Relation construct predicted by SMT) clarifies that the relationship

between a person's health and design of the physical environment may not be a direct relationship. An environment-based intervention may be better understood as a mediating factor that influences the *Person*, which in turn affects a person's *Health*.

### **Discussion**

The purpose of POWER Study was to explore symptom experiences of older women with OA when outdoors. This was the first study to use SMT as a conceptual framework for persistent pain from OA and the first study to explore the outdoor experiences of women with OA pain. Findings from the qualitative and quantitative methods were integrated to develop a situation-specific model. This integration of study findings into a refined model led to greater understanding of the *Self-care* concept with the *Symptom Status and Outcomes* construct. The development of this situation-specific model, therefore, provided information that will guide future theoretically based hypotheses with an ultimate goal of designing and testing OA pain management interventions using outdoor environments with nature.

#### ***Symptom Outcome: Self-care versus Symptom Management Strategy: Self-care***

As mentioned in Chapter 2, the situation-specific model includes the new concept of Self-care encompassed within the construct of *Symptom Management Strategy* (rather than in the *Symptom Status and Symptom Outcomes* construct). Self-management is emphasized as a treatment approach to interventions for OA pain<sup>69</sup> and therefore has particular relevance to this situation-specific model. There are challenges to determining the conceptualization of *Self-care* in SMT. In the original 1994 publication of SMT (as a 'Model for Symptom Management')<sup>27</sup> the term used was 'Self-Care Ability'. The next publication, in 2001, shortened the term to *Self-care*.<sup>6</sup> However, neither of these publications clearly addresses how to conceptualize *Self-care*. In the most recent publication on SMT<sup>28</sup> there is an emphasis on the importance of symptom

self-management and the need for increased understanding of "patients' self-care strategies".

This recent use of the phrase 'self-care strategies' supports the inclusion of a *Self-care* concept in the *Symptom Management Strategy* construct.

Use of the term 'Self-Care Ability'<sup>27</sup> and the 2008 publication<sup>28</sup> clarification that *Symptom Status and Outcomes* are "clear and measurable outcomes" is an indication that *Self-care* may be more closely related to a person's degree of independence (e.g., the ability to carry out activities of daily living; ADLs). Although the ability to carry out ADLs is linked conceptually to a person's *Functional Status* (another *Symptom Outcome*), there is a need to address the gap in this situation-specific model that is created by removing *Self-care* from this construct. Clarification of these terms is important and may be achieved through discussion of this situation-specific model with others interested in symptom management research.

### **Future Directions**

This situation-specific model, supported by the findings of the POWER Study, demonstrates clear directions for future research. The two most immediate needs are: 1) continued clarification and analysis of the SMT concepts and 2) research tools that can provide greater validity and reliability in the measurement of outdoor environments used by older women.<sup>149, 284</sup> In addition, relationships identified through development of the situation-specific model can be tested as hypotheses. The bi-directional relationships (represented by the long arrows near the top of the diagram in Figure 7.3) in the symptom management process are: 1) the direct association between *Symptom Experience: Perception* and *Symptom Status* as outcomes (including associated symptoms), 2) the relationship between *Self-care* strategies involving outdoor routines and *Symptom Status*, and 3) the relationship between *Symptom Experience: Response* and *Symptom Management Strategy: Self-care*.

Stated as hypotheses these bi-directional relationships would include:

1. *Symptom Experience: Perception* (of OA pain) will be positively associated with *Symptom Status* (bodily pain and fatigue).
2. Use of *Symptom Management Strategies*: 'Self-care' (i.e., self-care strategies) involving outdoor routines will be associated with improved *Symptom Status and Outcomes*.
3. *Symptom Management Strategies*: 'Self-care' that emerges from within an individual's *Symptom Experience: Response* will be associated with their *Symptom Experience: Evaluation* of the strategy (as effective or not effective).

### **Limitations**

Achievement of the fourth aim of the POWER Study shared the limitations from each phase of the study, as reported in Chapters 4, 5, and 6. Because the participants resided within the study site RCs in independent-living apartments, the findings of the POWER Study cannot be generalized to women who are living at a greater or lower level of independence. Overall, this study successfully applied systematic methods of inquiry to an understudied field of health care research and has advanced an understanding of the outdoor experiences of older women with OA pain.

### **Concluding Remarks**

The final section of the dissertation reviews the key insights and lessons from the POWER Study including the challenge of studying the influence of environment on health and addressing each of the four study aims. This dissertation focused on an increasingly popular field of science, the influence of the built environment on health. Measurement of environment is a key challenge; whether this measurement involves using objective data (as done in this study), subjective data, or both is a critical methodological challenge in this field of science.

Better measures of outdoor environments are needed. This interdisciplinary science needs a team approach to address both the environment design and health science issues.

Aim 1 addressed the *Symptom Experience* of older women in outdoor environments. This aim was accomplished using directed content analysis. The challenge of using a complex theory (SMT) with many constructs and concepts was initially daunting. Focusing the work most specifically on those concepts addressed within each aim helped mitigate the complexity of using the entire SMT. Aim 2 was not analyzed as planned due to the limited range of responses that directly addressed the research question about participants' experiences in two different outdoor spaces. Although the participants discussed their experiences in these specific outdoor spaces, there were few comments that differentiated experiences related to OA pain when in one space compared to the other. However, the information gained through the process of designing the interview questions based on SMT and then conducting the directed content analysis served to focus attention on clearly defining the SMT concepts. Use of directed content analysis increased the understanding of both the concepts and their relationships in SMT.

Quantifying the amount of time spent outdoors by older women with and without OA residing in the RC study sites was a particularly interesting aspect of the data collected for Aim 3. The aim was to compare time spent in outdoor spaces with a higher versus lower level of multi-sensory nature; this comparison found no significant difference between women with and without OA. Nonetheless, there were two important serendipitous findings. The first was that women with OA go outdoors on significantly few days per week, even though they tend to stay outside (on a day when outdoors) for about the same amount of time as women without OA. This finding (if it is replicated) raises the question of whether women stay indoors on some days because of OA pain or for some other reason. The second interesting finding is that although

there are differences in overall time spent outdoors (between women with and without OA), the two groups of women were remarkably similar in the amount of time spent in outdoor spaces within their RCs'. One implication of this finding may be that for women who spend more of their outdoor time "close to home," these RC outdoor spaces have greater importance.

Achieving the fourth aim led to development of a situation-specific model that provided directions for future study. The POWER Study made progress in a field of research (the influence of nature on health) that has great promise. Using all of the SMT constructs to collect and analyze a broad range of data in an area without previous study has laid a successful foundation on which to build a program of research. The next step is to develop this program of research further by designing studies that have a more narrow focus in order to address the many intriguing questions raised by these findings.

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## APPENDIX A

### Multi-sensory Nature Addendum

The information presented here is the Multi-sensory Addendum of the Access to Nature Outdoor Environment Tool, which added 14 new items to the original tool. The original tool can be accessed at: <http://www.accesstonature.org/OET.pdf>

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### Access to Nature Outdoor Environment Tool - Revised

**Purpose:** The Access to Nature Outdoor Evaluation Tool Revised (ANOET-R) can be used to evaluate outdoor environment design features of a senior congregate housing setting (e.g., retirement community, assisted living or skilled nursing facility). The tool assesses design features of an outdoor space, such as a courtyard, to examine whether residents can use those features in ways that provide opportunities to experience nature.

**Background:** The ANOET-R extends the original ANOET with 14 additional items to increase the nature related items regarding different types of sensory stimuli (auditory, olfactory, tactile, and gustatory, in addition to visual). Most outdoor or neighborhood environment instruments are inventories or audits; they assess the presence or absence of a feature. In contrast the ANOET evaluates affordance. Affordance is a construct that refers to opportunities that are available within an environment for a specified group of people. (Gibson, 1979) The ANOET was developed to evaluate whether features and characteristics provide an affordance that allows

older adults to access nature. It is essential to consider the characteristics of the residents who use the space that is being rated. For example, *easy to reach* will mean something different if the space is used by independent versus assisted living residents.

### **Instructions**

**Scoring:** Each item is scored by a rating of 0 to 10. The item includes a sentence that describes the best possible environment (score of 10). Some items include specific criteria for the ratings of 0, 5, 10, and N/A. If (in the evaluators judgment) the item should have a higher or lower rating than suggested by the item definition, then the evaluator may write an explanation on the back of the score sheet.

**Preparation for visit:** Dress according to weather (you will be spending 2 to 3 hours outdoors - bring a hat for sun, extra clothes for warmth). Bring your name badge, ANOET - R Binder with instructions and extra Score Sheets, and Extra pens. The location, staff member contact, information, site ID number and space ID number will be provided to you as needed.

**During Visit:** Identify boundaries of the space to be assessed. Begin by walking through the site and sitting in two different areas of the space (if possible). During the assessment, pause periodically (in between each principle) in a different area of the space to look, and then close your eyes as you listen, smell, and touch the nearby design features. For each principle - Reread the principle descriptions before completing each set of items. If you are uncertain of the answers to Multisensory-Addendum items (#s 8 and 13) because of the need to identify plants, then leave these items blank. After the assessment you may interview the facilities manager (or grounds person) regarding plant identification or, if the assessment is during the winter months. Clearly indicate on the score sheet if the item is scored based on this second-person reporting and the role of the person providing the information.

## Multi-Sensory Addendum

- 1. Residents can experience a sense of enclosure in this space which enables them to focus on the sensory stimuli in the immediate environment.**  
 This outdoor area provides the opportunity to focus on sensory stimuli in the immediate environment through both physical boundaries and design.  
 0 - No enclosure; the boundary of the space is hard to determine  
 5 - Clear boundaries, but the boundaries are open (such as a walkway or road) such that elements outside of the space are likely to attract attention.  
 10 - An area that is enclosed with a fence, hedge, or buildings on at least three sides. In order to have the highest rating the space must also be of a size that is appropriate. This may be a space that small or it may be a larger overall space with smaller nooks.  
**Note: Even if there is a clear boundary there may be site specific conditions that direct attention away from the sensory stimuli in the immediate environment (i.e., a spectacular or unusual view).**
- 2. Residents are not exposed to unpleasant sights.**  
 This outdoor area is relatively free from annoying sights, such as garbage, unrepaired buildings or equipment, or dead plants, etc. Note: Focus on what is within the space, however if there is no fence/hedge, and if the unpleasant sight is close to the space, then include this in your evaluation.
- 3. Residents are not exposed to unpleasant smells.**  
 This outdoor area is relatively free from annoying smells, such as garbage, cigarette smoke or other odors.  
 5 - If there are food odors, or if there is any smell that you think some people might consider unpleasant, then do not give more than a rating of 5.  
 10 - No unpleasant smells noticed.
- 4. Residents are not exposed to unpleasant tactile experiences.**  
 This outdoor area is relatively free from annoying or uncomfortable elements that are difficult to avoid touching, such as branches with thorns overhanging pathways or seating, or plants sited to invite touching, but which are irritating to the skin (e.g., meadow rue), etc  
 1 - Multiple opportunities that are difficult to avoid, such as sharp corners on planters or benches, branches with thorns in pathway, etc..  
 5 - A few rough edges, but easily avoided.  
 10 - Exceptional area with almost no sharp or rough edges on any feature.

- 5. Residents can easily hear a water feature (or some other feature that produces pleasant sounds on a regular basis) from walking past or from a comfortable seating area.** (auditory)

Residents can hear water in this outdoor area, whether a small fountain, pool, duck pond, or even a well-filled birdbath, or a nearby stream, river, or lake. They can hear it easily from comfortable places to sit.

0 - No feature (human made) that produces sound

5 - Sound level that is audible to many older adults, but there is no seating close by.

10 - Sound level as above and places to sit that are near enough to hear.

- 6. Animals (wild or domestic) are likely to be heard during a visit to this space.** (auditory)

From this outdoor area, residents have a good chance of being able to hear animals, including wildlife, such as birds, dogs, cats, etc. – whatever might be found in this type of community.

**1 - lack of elements that might attract animals AND no animals heard**

**5 - some elements that might attract animals**

**10 - multiple elements that might attract animals AND multiple animals heard (i.e., several birds)**

- 7. This outdoor area has plants with pleasant fragrance at the time of the assessment.** (olfactory)

The outdoor area contains at least some plants with a scent that would be noticed by elderly residents when visiting this space during the current season of the year.

**Note: close your eyes and smell in at least three different areas of the space**

0 - no fragrance noted from plants

5 - Subtle fragrance noted while in this space, might be noticed by some visitors to this space

10 - A distinct and pleasant fragrance is experienced while in the space and is likely to be noticed by most visitors to the space

- 8. This outdoor area is likely to have pleasant fragrances from plants throughout the year.** (olfactory)

The outdoor area contains a variety of plants likely to produce scents during different seasons of the year that would be noticed by elderly residents.

0- no variation identified

5-some variation of fragrance is likely during at least two seasons of the year (based on identifying plants)

10-seasonal variation is likely throughout all seasons of the year (based on identifying plants)

- 9. Residents can easily reach plants that release a pleasant fragrance when touched.** (olfactory)  
There are herbs or other aromatic plants that are soft to the touch, within reach from a standing position (3 to 4 feet off the ground), or within reach next to seating, and which release a pleasing fragrance onto the hand. (Note: touch various plants and smell your fingers)
- 10. Residents can easily touch nature of different types and textures.** (tactile)  
There are a wide variety of opportunities to easily touch nature, including leaves, bark, water, and rocks.  
0 – no opportunities  
5 – It is easy to touch leaves, but not bark or rocks  
10 – Multiple opportunities, including water, and there is seating near trees with bark that has textural interest and rocks with variation in texture.
- 11. There is a convenient and comfortable place where residents can grow plants.** (tactile)  
The beds are raised and all parts of the planting surface can be reached easily, even for people in wheelchairs. The watering system allows residents to take care of plants without physical strain. Tools can be kept nearby and are easily reached. Nearby shaded seating is provided, so residents can watch others working with the plants.
- 12. Residents can easily reach plants edible plants that are available for them to enjoy.** (gustatory)  
There are herbs, fruit, or vegetables grown and cared for by residents or staff, and available to be picked by all residents during the current season. To be in easy reach the edible portion of the plant should be about 3 to 4 feet off the ground.  
**NOTE: unless there is an obvious community herb or vegetable garden, list the edible plants.**  
1 - There are no plants that are available to ALL residents.  
5 - There is at least one plant that is available to all residents.  
10 - There are multiple plants located in a convenient place and available to all residents
- 13. This outdoor area is likely to have edible plants in different seasons of the year which residents can easily reach that are available for them to enjoy.** (gustatory)  
There are herbs, fruit, or vegetables available, to the extent possible in this geographic location, during at least two seasons the year. (Same definitions as above)
- 14. There is a comfortable and convenient place where residents can eat outdoors.** (gustatory)  
There is table with chairs, a cooking area (e.g., barbecue), and protection from the sun and wind which provides for comfort while eating.

## APPENDIX B

## Description of Outdoor Spaces at each Study Site

Site	Similarities	Differences	
		"Lower Contact with Nature"	"Higher Contact with Nature"
<b>1</b>	<p>Paved (with pavers and concrete slabs)</p> <p>Same outdoor furniture (heavy metal chairs, tables with umbrellas)</p> <p>Plantings are similar in character</p>	<p>South <sup>a</sup></p> <p>Secondary <sup>b</sup></p> <p>Not visible from main lobby</p> <p>Small space, enclosed</p> <p>Plantings are similar in character, but there are many fewer and there is less variety.</p>	<p>West</p> <p>Main</p> <p>Visible from main lobby</p> <p>Very large space, not enclosed</p> <p>Alcoves surrounded by plantings</p> <p>Many flowers in large pots that bring plants up to waist level</p> <p>Wide variety and abundance of plants</p> <p>Small bubble fountain and arbor</p>
<b>2</b>	<p>Similar in size</p> <p>Terrace (both are accessed directly from building)</p> <p>View of city and nearby trees</p> <p>Same outdoor furniture (sturdy, but not heavy, chairs, tables with umbrellas)</p>	<p>West</p> <p>Bordered by buildings to the south and east</p> <p>All plants in raised beds or pots</p> <p>Terrace deck is composed of large pavers closely spaced making a smooth surface.</p> <p>A few plants in pots</p> <p>Many plants/trees can be seen outside of the area, but within the area there is little variety in the plantings</p>	<p>West</p> <p>Waist high wall surrounding the terrace with built in planter</p> <p>Free-standing large built in planters (with trees)</p> <p>Abundance of different varieties of trees and plants</p> <p>Planters for gardening managed by a resident group</p> <p>Community herb garden</p> <p>Many plants/trees can be seen outside of the area</p>
<b>3</b>	<p>Paved (with concrete slabs)</p> <p>Similar furniture (benches)</p>	<p>East</p> <p>Entryway</p> <p>Smaller space</p> <p>Next to main lobby</p> <p>Benches, and a table with fixed benches</p> <p>Next to driveway with cars</p> <p>Hanging baskets with flowers and several pots</p> <p>Paved, concrete slab (sidewalk)</p> <p>Many plants, including trees along one edge</p>	<p>North</p> <p>Main</p> <p>Very large area covered with grass and planting beds, except for paved path and two areas to sit.</p> <p>Multiple trees over 30 feet tall provide canopy over most of the area</p> <p>Benches</p> <p>Table with stable chairs</p> <p>Nook with bench seating</p> <p>Planters for resident gardens</p>

Site	Similarities	Differences	
4	Spaces are of different types (ground-level and terrace spaces) Seating is similar	East Terrace Smaller area Smooth flooring Building on one side, other sides have a wall more than waist high Views of nearby trees, mountains and city Planters for resident gardens A few small pots with plants Tables and chairs, one umbrella	Southeast Main Larger area, Ground-level Concrete slab paving Abundant plantings, trees mostly are under 10 feet Water feature Raised beds for resident gardens Seating is limited (this was variable, on one visit there were no chairs or table).

**Note.** <sup>a</sup> Each outdoor space has an exposure to the sun based on the orientation of the space and adjacent buildings. An outdoor space with a southern exposure will receive the greatest amount of sunlight. <sup>b</sup>Main = a centrally located space, Terrace = a space above ground level, usually with smooth flooring, Entryway = an entrance with an attached area that includes opportunities for activities beyond sitting on a bench by the door, Secondary = similar to main, but not centrally located.

**APPENDIX: C****Phase 1 - Background Information Form**

Participants in Phase 1 of the POWER Study completed the form on the next page.

Please answer the following questions by checking the box or filling in the blank.

1. Age: \_\_\_\_\_
2. Gender:     female             male
3. Has a health care provider (doctor, nurse practitioner, or physician assistant) told you that you have the diagnosis of osteoarthritis in one or more joints? (*Osteoarthritis is sometimes called arthritis, but it is not the same thing as rheumatoid arthritis.*)  
 yes             no
4. Which joint (or joints) are affected by the arthritis? Check all that apply.  
 Hip  
 Knee  
 Hand  
 Back (spine)  
 Other \_\_\_\_\_
5. How long ago were you diagnosed with arthritis (as best you recall)?  
 Less than one year  
 One to five years  
 More than five years
6. This question is about any pain or discomfort that you have from arthritis. Please rate your pain by checking the one number that best describes your pain at its worst in the last week.  
  

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7	8	9	10
no										Pain as bad as
pain										as you can imagine
7. On how many days last week did you have pain or discomfort in your joints  

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6	7

8. Do you have any other problems with your joints besides arthritis?  
 yes       no      If yes, please write the name of the other joint problem
- 

9. Do you use anything to assist you when you go outdoors (check all that apply)?  
 cane       walker       scooter       wheel chair

10. Do you need daily assistance from another person with walking, dressing, bathing, toileting, or eating?

yes                       no

11. What is the highest grade in school you finished?

- Didn't go to school
- Grade school (1st-8th grade)
- High school
- Two year college or vocational school
- Four year college
- Master's degree
- Doctoral degree

12. Please check the box that describes your ethnicity:

- Hispanic or Latino
- Not Hispanic or Latino

13. Please check the box(es) that describe your race:

- American Indian/Alaskan Native
- Native Hawaiian/Pacific Islander
- Black/African American
- Asian American
- White
- Other \_\_\_\_\_
- Unknown

14. Do you currently live with a partner?                       yes                       no

**Appendix D**  
**POWER Study Phase 1**  
**Interview Guide**

*Note: The participant will have signed a consent form prior to beginning this interview.*

Thank you for participating in this study about women's experiences with arthritis pain when outdoors. I want to know about your experiences in different outdoor places. Some of the questions I ask will be in a series with each one just a bit different from the question before. This helps me to understand more about your experience when outdoors. Even though this will be recorded, I will be taking some notes to help me keep track.

Do you have any questions before we start?

**1. Before we talk about your experiences with arthritis pain, I would like to ask how long you have lived in your current apartment.**

**2. When you are inside your apartment, how do you get outdoors?**

*Probe: For example, is there a porch or balcony, or do you get outdoors by first going into a hallway?*

**3. Tell me about your experience with arthritis pain or discomfort on a usual day.**

*Probe:* What do you do to manage arthritis pain?

*Probe:* Could you tell me more about what happens when you ..... ? [State one of the strategies mentioned giving preference to nondrug strategies.]

*Probe:* Can you compare how you feel before you do the [name of strategy] with after you do the....

**4. Tell me about going outdoors on a usual day for you.**

*If the person does not spontaneously talk about outdoor places, then:*

*Probe:* Tell me about the places you go outdoors.

*If the response is that the person does not usually go outdoors, then*

*Probe:* If you don't go outdoors on a usual day, then tell me about the places you occasionally go outdoors.

*If the response is that the person never goes outdoors (or only goes outside when getting into a vehicle to go to another indoor location), then*

*Probe:* Tell me about an outdoor place that you used to go.

**5. What might encourage, or discourage, you in going outdoors?**

*Probe: Could you tell me more about - [expand on what the person has said providing a contrast - for example - if the person has talked about the effect of wind and cold ; ask about the opposite - sun and heat.*

The next questions are about your experience with arthritis pain when you are in this place [*show picture 1*]. This is a picture of an outdoor place in this community.  
PICTURE should be put away

**6. Do you ever go to this place? -**

*IF yes, then - How often do you go there?*

*Probe: What do you do when you are in this place?*

*[If no (or if the answer to #2 indicated the person does not go outdoors)]*

*Probe: What might you do if you were in this place?*

*[(Note: continue in the same manner below, adjusting the questions with wording for 'might'.)]*

**6.a. Tell me about how your joints feel when you are in this place. (perception question)**

*Probe: What are you aware of in terms of arthritis pain or how your joints feel when you are outdoors in this place?*

**6.b. What about this place affects how your joints feel? (evaluation question)**

*Probe: How might this place affect how your joints feel?*

**NOTE: What might you see / hear / smell / touch / taste ...**

**6.c. What do you do, if anything, when you have arthritis pain or discomfort in this place?**

*(response question)*

*Probe: How does doing this influence the arthritis pain?*

**6.d. What, if anything in particular, about this place affects your awareness of arthritis pain?**

*Probe: What, if anything in particular, about this place interests you or captures your attention?*

**6.e. How do your joints feel when you go back indoors after being in this place?**

The next questions are about your experience with arthritis pain when you are in this place [*show picture 2*]. This is a picture of an outdoor place in this community.

PICTURE should be put away

7. *Second space (repeat questions in # 6).*

**Do you ever go to this place?** - PICTURE should be put away

*IF yes, then - How often do you go there?*

*Probe: What do you do when you are in this place?*

*[If no (or if the answer to #2 indicated the person does not go outdoors)]*

*Probe: What might you do if you were in this place?*

*[(Note: continue in the same manner below, adjusting the questions with wording for 'might'.)]*

7a. **Tell me about how your joints feel when you are in this place.** (*perception question*)

*Probe: What are you aware of in terms of arthritis pain or how your joints feel  
when you are outdoors in this place?*

7.b. **What about this place affects how your joints feel?** (*evaluation question*)

*Probe: How might this place affect how your joints feel?*

**NOTE: What might you see / hear / smell / touch / taste ...**

7.c. **What do you do, if anything, when you have arthritis pain or discomfort in this place?**

*(response question)*

*Probe: How does doing this influence the arthritis pain?*

7.d. **What, if anything in particular, about this place affects your awareness of arthritis pain?**

*Probe: What, if anything in particular, about this place interests you or captures  
your attention?*

7.e. **How do your joints feel when you go back indoors after being in this place?**

**8. Is there anything else that you want to tell me about being outdoors and your experience with arthritis pain or discomfort?**

**Thank you so much for talking with me today.**

**APPENDIX: E****Phase 2 - POWER Study Survey**

Participants in Phase 2 completed the survey on the next page.

## **POWER Study Survey**

**Instructions:** *Do not put your name or other contact information on this form.*

Please answer the following questions as completely as possible. Most questions can be answered by marking a box with a check (✓). If you prefer to skip a question, feel free to write “decline” and go to the next question.

1. Age: \_\_\_\_\_

2. Gender:    Female                       Male

3. How long have you lived in this retirement community?  
 Less than 1 year                       1 to 5 years                       More than 5 years

4. What are the reasons you chose to live here at [name of community]?

~please mark **all** boxes that are true for you ~

- I lived close by before I moved to this community
- I have family or friends close by
- Support services (for example dining room, health care, house cleaning)
- Downsizing (moving to a smaller home)
- Safety and security
- Social programs (group activities, outings)
- I liked the inside spaces (your apartment, shared community rooms)
- I liked the outdoor spaces (the grounds of your retirement community)
- Other \_\_\_\_\_

5. Do you have a pet?

- No                       Yes —————> What kind of pet do you have?
- ↓
- Dog                       Cat                       Bird                       Fish                       Other

6. Do you live alone in your apartment?

- Yes       No —————> Who lives with you?
- ↓
- Spouse/Partner
- Family member (not including spouse)
- Friend
- Other\_\_\_\_\_

7. Do you use anything to assist you when you go outdoors?

- No       Yes —————> Please mark **all** the things you use outdoors:
- ↓
- Cane       Walker       Scooter       Wheel chair

8. Do you have help with housework (for example vacuuming and laundry)?

- No       Occasionally       Weekly       Daily
- (less than weekly)

9. What is your highest level of education?

- Grade school (1st-8th grade)
- High school
- Completed some college, or community college or vocational school
- College graduate
- Graduate degree (Master's or PhD)

10. Please mark the box that describes your ethnicity:

- Hispanic or Latino       Not Hispanic or Latino

11. Please mark the box(es) that describe your race:

- American Indian/Alaskan Native
- Native Hawaiian/Pacific Islander
- Black/African American
- White
- Other\_\_\_\_\_





22. What outdoor activities do you currently enjoy? (Please mark **all** that apply)

- Quiet activities, like reading or knitting
- Sitting
- People watching
- Walking or hiking
- Visiting or social gatherings with friends or family
- Playing games, like cards or chess, that can be done while sitting down
- Gardening
- Active games, like golf, baseball, or horse shoes
- Activities that include nature, like bird watching
- I don't enjoy outdoor activities
- Other (please describe) \_\_\_\_\_

23. Are there outdoor activities that you used to enjoy, but have stopped doing?

- No       Yes → Write the name of one of these activities here:  
 \_\_\_\_\_
- ↓
- Please mark the reason you no longer do this activity:
- Pain       No longer interested       No opportunity       Other \_\_\_\_\_

***The next questions are about your health.***

24. In general, would you say your overall health is:

- Excellent       Very good       Good       Fair       Poor

25. In general, would you say your overall quality of life is:

- Excellent       Very good       Good       Fair       Poor

26. How much bodily pain have you had during the past 4 weeks?

- None       Very mild       Mild       Moderate       Severe       Very severe

27. During the past 4 weeks, how much did bodily pain interfere with your work, including both work outside the home and housework?

- Not at all       A little bit       Moderately       Quite a bit       Extremely

28. What is your height? \_\_\_\_\_feet \_\_\_\_\_inches

29. What is your weight? \_\_\_\_\_pounds

30. Do you currently take anything for pain?

(This might include prescriptions or non-prescription medications, herbs, or supplements.)

No       Yes → Please list everything you take for pain below:

	Name	Reason for taking it
↓	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____

31. Has a health care provider told you that you have osteoarthritis (OA)?

(*Osteoarthritis is not the same thing as rheumatoid arthritis or osteoporosis.*)

No       Yes → Which joints are affected by osteoarthritis? Mark **all** that apply.

Hip

Knee

Hand

Back (spine)

Other \_\_\_\_\_

To the best of your memory, how long ago were you diagnosed with osteoarthritis?

Less than 1 year

1 to 5 years

More than 5 years

32. Do you smoke?

Never

Current

Former

33. Do you have a health condition that limits your activity?

No       Yes → Please mark **all** conditions that currently limit your activity:

- Arthritis/rheumatism
- Back or neck problem
- Fractures, bone/joint injury
- Lung/breathing problem
- Heart problem
- Stroke problem
- Hypertension/high blood pressure
- Diabetes
- Cancer
- Depression/anxiety/emotional problem
- Other impairment/problem\_\_\_\_\_

34. If you have had an operation in the past 6 months, please write the type of operation here:

---

35. How would you describe your hearing (corrected with hearing aid, if needed)?

- Excellent       Very good       Average       Poor       Very poor

36. How would you describe your vision (corrected with glasses or lenses, if needed)?

- Excellent       Very good       Average       Poor       Very poor

37. What exercise classes (if any) do you currently go to on a regular basis? (Please list)

**Name of class**

**Number of times per week**

_____	_____
_____	_____
_____	_____
_____	_____

Questions 38-63 were removed from this survey, as these questions comprise the Arthritis Impact Measure Short Form (AIMS2 SF).

To locate a copy of this instrument:

1. Go to the American College of Rheumatology web site  
Practice Management  
Outcome Instrumentation

<http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/AIMS.asp>

2. Contact the developer of the tool

Francis Guillemin

email: [francis.guillemin@chu-nancy.fr](mailto:francis.guillemin@chu-nancy.fr)

AIMS2 SF 1.3 - Quality of Life Group in Rheumatology, France 1995. Arthritis & Rheumatism 1997; 40: 1267-74 Adaptation from AIMS2 - R. Meenan - Boston, Ms

64. We are very interested to know, from your point of view, how going outdoors affects your health and / or osteoarthritis pain (if you have osteoarthritis).

Please write about your experience in the space below:

***Thank you so much for completing this survey!***

We greatly appreciate your participation in this research. You can turn in your survey by putting it in the box at [location] **or** mail the survey, using the pre-addressed postage-paid envelope.

**CURRICULUM VITAE**  
**Grace A. Kline, PhD, RN**

**Education**

Degrees:

PhD, Nursing Science, University of Washington, Seattle, School of Nursing, 2012

MN, Nursing of Children, University of Washington, Seattle, WA, 1986

BS, Nursing, California State University Fresno, Fresno, CA, 1980

Doctoral Dissertation:

*Pain of Osteoarthritis in Women: Environment Research*

University of Washington, Seattle, 2012

Master's Thesis:

*Early Communication Development in Children with Failure to Thrive*

University of Washington, Seattle, 1986

Other Education (selected):

Therapeutic and Healing Gardens Certificate, University of Washington, Seattle, 2007

**Professional Experience (selected)**

Group Health Cooperative / Center for Health Studies

Research Interventionist (7 – 9/2008)

Research Specialist II (3 – 12/2006; 9/2004 - 8/2005)

Seattle King County Department of Public Health

Public Health Nurse, Child Care Health Team (12/1997- 8/1998)

Seattle King County Department of Public Health

Public Health Nurse, research project (4/1992-5/1993)

University of Washington, Seattle, Washington

Research Assistant, School of Nursing (1985 - 86)

Teaching Assistant, School of Nursing, (1986)

Children's Hospital and Medical Center, Seattle Washington

Staff Nurse (1982 - 1986)

University Hospital, Seattle, Washington,

Staff Nurse, Clinical Research Center (1981- 1982)

Valley Children's Hospital, Fresno, California

Staff Nurse (1980)

**Publications**

Kline, G.A. (2009). Letter to the Editor. *Advances in Nursing Science*, 32(2), 106.

Kline, G.A. (2009). Does a view of nature promote relief from acute pain? *Journal of Holistic Nursing*, 27(3), 159-166. PMID: 19755566

### **Conference Presentations**

- Pain of Osteoarthritis in Women: Environment Research (Phase 2).* (Authors: Kline GA, Cochrane B, Taibi, D) Poster presentation. American Pain Society, Honolulu, Hawaii, May 2012.
- Pain of Osteoarthritis in Women: Environment Research (Phase 1).* (Authors: Kline GA, Cochrane B, Manzo, L) Poster presentation. Western Institute of Nursing, Communicating Nursing Research Conference. Portland, Oregon, April, 2012.
- Older Women with Osteoarthritis and Outdoor Environments.* (Authors: Kline GA, Cochrane B) Poster presentation. American Pain Society, Annual Scientific Meeting. Austin, Texas, May, 2011.
- Refining an Outdoor Environment Assessment Instrument.* (Authors: Kline GA, Cochrane B) Poster presentation. Western Institute of Nursing, Communicating Nursing Research Conference, Las Vegas, Nevada, April, 2011.

### **Research Experience**

#### Principal Investigator:

Pain of Osteoarthritis in Women: Environment Research. Dissertation Research (mentored by Barbara Cochrane, PhD), University of Washington, Seattle, 2011. Funded by: Hester McLaws Nursing Scholarship Award and NCRR Grant TL1 RR 025016

Pilot Study for Older Women with Osteoarthritis and Outdoor Environments (mentored by Barbara Cochrane, PhD), University of Washington, Seattle, 2010.

Early Communication Development in Children with Failure to Thrive; (mentored by Marion Rose, PhD), University of Washington, Seattle, 1986.

### **Teaching Experience**

- Built Environment and Health*, guest presentation, Human Health Ecology (NURS 590) University of Washington, Seattle, WA, 11/15/2011.
- Built Environment and Health*, guest presentation, Human Health Ecology (NURS 590) University of Washington, Seattle, WA, 11/16/2010.
- Built Environment and Health*, guest presentation, Human Health Ecology (NURS 590) University of Washington, Seattle, WA, 10/27/2009.
- Therapeutic and Healing Gardens in the Puget Sound Region*, guest presentation, Ethics and Aesthetics (BNURS508) University of Washington, Bothell, WA, 11/14/2008.
- The Therapeutic Value of Views of Nature for Patients with Acute Pain*, guest presentation, Therapeutic/Healing Gardens certificate program (LARCH 498) University of Washington, 11/27/2007.

**Invited Presentations**

*Therapeutic Gardens for older Adults in the Puget sound Region*, guest presentation, Gerontological Professionals Network, Seattle, WA, 10/8/2009.

*Therapeutic and Healing Gardens*, guest presentation. NW Therapeutic Horticulture (formerly chapter of the American Horticultural Association), 4/11/ 2009.

*Therapeutic and Healing Gardens in the Puget Sound Region*, guest presentation. Harrison Medical Center, Bremerton WA, 9/2007.

*What is a Healing Garden?* CAM Brown Bag Seminar, University of Washington, Seattle, WA, 5/2007.

**Awards**

Hester McLaws Nursing Scholarship Award

Institute of Translational Health Sciences, Multidisciplinary Clinical Research Training Program, TL-1 Trainee

**Professional Organizations**

Western Institute of Nursing

Gerontological Society of America

Sigma Theta Tau International

American Pain Society

**Community Service**

Therapeutic/Healing Garden Design Certificate Program, Advisory Board, University of Washington Professional and Continuing Education, 2009 - 2011

PhD Coordinating Committee, Student Representative, University of Washington, School of Nursing 9/2008 – 6/2010