RELATIONSHIP OF EMOTION AND COGNITION TO WANDERING BEHAVIORS OF PEOPLE WITH DEMENTIA

by

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To my parents

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ABSTRACT

Relationship of Emotion and Cognition to Wandering Behaviors of People with Dementia

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Wandering is one of the most frequently encountered dementia-related behavioral disturbances and has been associated with negative consequences such as higher morbidity and mortality. In terms of relating factors of wandering, it has become increasingly clear that a close relationship exists between emotion, cognition, and behavior. However, little research has focused on the influence of emotion on wandering of people with dementia (PWD). The purpose of this study was to explore the relationship of emotion and cognition to wandering behaviors of PWD. This study applied a secondary data analysis utilizing a parent study that used a cross-sectional design with repeated measure nested within subjects. A total of 115 PWD in 17 nursing homes and six assisted living facilities in Michigan and Pennsylvania were included. Subjects were randomly assigned to six 20 minute observation periods, conducted on two non-consecutive days; their behaviors were videotaped. Poisson hierarchical linear modeling (HLM) was utilized to determine factors associated with wandering. Positive emotional expression increased wandering rates whereas negative emotional expression and higher MMSE score decreased wandering rates after controlling for other predictors (i.e., age, education, gender, and time of day). Therefore, both positive/negative emotional expression and cognition influence wandering; a tailored intervention that addresses both emotional and cognitive functioning may be required to improve wandering behaviors of PWD.

CHAPTER I
INTRODUCTION

The Problem and Background

As the number of people living to the age of 65 and above has increased, so has the number of elderly with dementia. Thirty-nine million people age 65 and over lived in the United States in 2008, accounting for just over 13 percent of the total population (Federal Interagency Forum on Aging Related Statistics, 2011). The elderly population in 2030 is expected to be twice as large as it was in 2000, growing from 35 million to 71.5 million and representing nearly 20 percent of the total U. S. population (Federal Interagency Forum on Aging Related Statistics, 2011). In a recent report, it was revealed that over 5 million people age 65 and older suffer from Alzheimer's disease and the prevalence of Alzheimer's disease will grow as fast as the baby boomers age (Alzheimer's association, 2010). The socio-economic burden of caring for people with dementia is growing alongside dementia's increased prevalence, since dementia care is particularly time-consuming and expensive. According to the Alzheimer's Association (2010), costs for the care of people with dementia were $172 billion in 2010 and they will increase up to $1.08 trillion in 2050.

As dementia progresses, functional impairment and behavioral disturbances often emerge to accompany the significant cognitive impairment of dementia (Wooltorton, 2002). Behaviors such as agitation, wandering, and problematic vocalizations are related to caregiver burden, institutionalization, and care costs (Donaldson, Tarrier, & Burns, 1997; Lyketsos, et al., 2000; Martin, Ricci, Kotzan, Lang, & Menzin, 2000). A majority of patients experience behavior disturbance at some time during the course of dementia. In a representative study, almost all nursing home residents presented at least one behavioral problem, and half showed four or more behavioral problems (Tariot, Teri, Porsteinsson, & Weiner, 1996).

Wandering, dementia-related locomotion behavior, is one of the most common behavioral disturbances. Although estimates of wandering vary widely, its prevalence among the community-residing elderly with dementia is reported to be as high as 50% (Teri, Larson, & Reifler, 1988). The Alzheimer’s Association estimates that up to 60% of persons with Alzheimer’s disease (AD) will wander at some point over the course of the disease (Alzheimer's Association, 2007). Wandering has also been associated with patient morbidity (Evans & Strumpf, 1989; Rheaume, Riley, & Volicer, 1988) and mortality (Moritz, Fox, Luscombe, & Kraemer, 1997) due to safety risks including elopements, falls, and injuries; it has also been reported to require costlier care (Lam, Sewell, Bell, & Katona, 1989). In order to design interventions for wanderers, an understanding of wandering behaviors is essential.

In terms of those factors related to wandering, it has become increasingly clear that a close relationship exists between emotion, cognition (i.e., mental processes involving in thinking such as memory, attention, perception, etc.), and behavior (Bucks & Radford, 2004). Emotion involves both conscious and unconscious mental response to be mediated by neural systems and to lead to behavior (Kleinginna & Koeinginna, 1981), which includes emotional expression and emotional recognition. Positive or negative emotions are expressed via the face, voice tone, and body posture; emotional recognition is the ability to perceive emotion expressed by others. Based on current knowledge of brain function and connectivity, Pessoa (2008) stated “emotion and cognition not only strongly interact in the brain, but also are often integrated so that they jointly contribute to behavior” (p. 148).

From a theoretical standpoint, the Need-driven Dementia-compromised Behavior (NDB) Model explains how dementia-related behavior results from the interplay of background and proximal factors (Algase, et al., 1996). Background factors include neurological factors, cognitive factors, health status, and psychosocial factors; proximal factors include both physical and social environments and personal factors including emotions and physiological need states (Algase, et al., 1996). Cognitive factors and emotions, then, often critically influence wandering behaviors.

Therefore, this study sought (1) to explore emotion of people with dementia and (2) to examine the relationship of cognition and emotion to wandering behaviors of people with dementia (PWD).

Significance of Study

Although the number of studies concerning PWD has increased, some gaps still remain. While most studies have focused on cognitive aspects of dementia, relatively few studies have shown the influence of emotional aspects of dementia (Bucks & Radford, 2004). In this section, the significance of this study is justified by the relative lack of studies on emotion in dementia— particularly as compared to the number addressing cognition— as well as inconsistent results across existing studies.

Most studies in dementia have focused on cognition because dementia itself is a progressive neurodegenerative disease and cognitive impairment is a key predictor of early stage dementia. Recently, although research on emotion of PWD has received greater attention, the research on emotion remains sparse compared to that on cognition (Scheibe & Carstensen, 2010). In addition, their results were also inconsistent. Some studies confirm that cognitively impaired people show impoverished emotional expression (Asplund, Norberg, Adolfsson, & Waxman, 1991; Daffner, Scinto,, Weintraub, Guinessey, & Mesulam, 1992). On the other hand, more recent studies have suggested that PWD preserve the ability to express emotions facially (Kolanowski, Hoffman, & Hofer, 2007; Magai, Cohen, Gomberg, Malatesta, & Culver, 1996).

However, clinical experience consistently shows that abilities to express emotion remain undamaged even after other cognitive functions have become significantly impaired (Bartol, 1979; Finnema, Dröes, Ribbe, & Van Tilburg, 2000; Finnema, et al., 2005). Bartol described nonverbal communication on an emotional or nonintellectual level as playing an increasingly important role in providing effective nursing care when verbal communication is absent or impaired (Bartol, 1979). Many studies have shown that emotion-oriented approaches to nursing intervention (e.g., supportive psychotherapy, sensory integration, and reminiscence) lead to positive results, including a decrease in problematic behaviors and an increase in social interaction (Finnema, Dröes, Ribbe, & Van Tilburg, 2000; Finnema, et al., 2005). In particular, a randomized clinical trial study showed emotion-oriented care is more effective than standard care with regard to positive emotion in nursing homes residents with mild to moderate dementia (Finnema, et al., 2005). Thus, further research is necessary to clarify effects of dementia on emotional expression of PWD, so as to improve nursing care.

In addition, only a few studies have examined the correlation between wandering and psychological symptoms and emotional expression. Several studies have shown that anxiety symptoms were significantly correlated with wandering (Kiely, Morris, & Algase, 2000; Teri, et al., 1988). Another study found that sadness may also contribute to night wandering (Hope, et al., 2001), and major depression also has been associated with more frequent and serious wandering, even after adjusting for the severity of the dementia or comorbid health problems (Lyketsos, et al., 1997). Only one study by Yao and Algase (2008) examined the relationship between emotional ambiance (i.e., emotional valence of an environment) and wandering.

According to the NDB model, emotion is indeed one of the important contributors to wandering (Algase, et al., 1996). Psychological need states, as one of the proximal factors, are seen as dynamic or influx, rather than persistent affective states. Psychological need states were operationalized as positive and negative emotional expression. Few prior studies have examined the relationship between emotion as a dynamic feature and wandering. Thus, further study is required not only to add to our understanding of emotional expression in dementia but also to address the association between emotion and wandering.

Cognition and emotion are at least partially connected; behavior depends on the functions of both. In particular, better understanding of the cognitive mechanism and the emotion of people with dementia usefully contributes to an understanding of wandering behaviors. Furthermore, wandering behavior, while a challenging dementia-compromised behavior, may be manageable. Thus, further study is needed to comprehensively examine the relationship between cognition and emotion, so as to clarify and potentially mediate wandering behaviors in dementia.

Purpose of Study

The purpose of this study was to explore the relationship of emotion and cognition to wandering behaviors of people with dementia. The following specific aims and related research questions were addressed:

Aim1. To explore emotional expression in PWD over the daytime period.

Question 1.1. How do positive and negative emotional expression relate to each other?

Question 1.2. Does observable emotional expression vary by resident characteristics, cognition, and time of day?

Question 1.3. Are there distinctive trajectory groups in observable emotional expression of PWD during the daytime?

Aim2. To examine the relationship between patterns of emotion and wandering in PWD

Question 2.1. Do patterns of positive observable emotional expression differ between wanderers and non-wanderers?

Question 2.2. Do patterns of negative observable emotional expressions differ between wanderers and non-wanderers?

Aim3. To examine the relationship between frequencies of emotion and wandering in PWD

Question 3.1. How does observable emotional expression relate to wandering in PWD?

Question 3.2. Does observable emotional expression predict wandering in PWD after controlling for cognition, resident characteristics, and time of day?

CHAPTER II
LITERATURE REVIEW

This chapter presents findings from a literature review on cognitive and emotional factors related to wandering behaviors of people with dementia. The terms wandering behavior, emotion, and cognition were selected as key concepts for the literature search. This review offers the readers fundamental understanding of wandering, emotion, and cognition among those with a dementia. This chapter is organized into five main parts: (1) a literature review of wandering behavior in people with dementia; (2) a review of the role of emotion in dementia; (3) a review of the role of cognition in dementia; (4) a summary of the parts played by emotion and cognition in dementia; and (5) an explanation of this study's conceptual framework.

Wandering Behavior in People with Dementia

This section presents a summary review of the literature regarding wandering: (1) what is it; (2) how prevalent is it; and (3) what factors contribute to it.

Wandering is one of the most frequently encountered behaviors of people with dementia. Wandering behavior of people with dementia (PWD) has been considered problematic to wanderers, caregivers, health professionals, and policy makers alike because it is behavior that imparts high risk of falls and other problems, as well as adding to general health care and related expenses (Moore, Algase, Powell-Cope, Applegarth, & Beattie,2009). Wandering is related to falls, injuries, and early hospitalization (Buchner & Larson, 1987; Scarmeas, et al., 2007; Tinetti, Liu, Marottoli, & Ginter, 1991). Wandering has even been reported to be one predictor of mortality in patients with Alzheimer's disease (Moritz, et al., 1997). Getting lost and unwillingly leaving the safety of one's surroundings have also been reported among the adverse outcomes of wandering (McShane, et al., 1998), which is a heavy burden on both wanderers themselves and their caregivers. Dementia-related problematic behaviors including wandering have been linked to numerous negative outcomes in caregivers, including psychological disturbances (Marini, Vulcano, Savorani, & Cucinotta, 1997), physical health problems (Golodetz, Evans, Heinritz, & Gibson, 1969), and relationship changes (Morris, Morris, & Britton, 1988). In addition, a Korean study found that wandering is a mediator between impairment of cognition and Activity of Daily Living (ADL) and dependency in ADL and caregiver burden (Lim, Son, Song, & Beattie, 2008).

Although the cost of wandering has not been isolated, the yearly cost of informal care per case of moderate dementia was found to be $7,420, and for severe dementia, $17,700 (Langa, et al., 2001). As wandering occurs most often in moderate and severe dementia, and often precipitates institutional care, it is highly contributory to these costs. Thus, the socio-economic burden of caring for people with dementia who wander is likely greater than for those who do not.

Along with the high cost of wandering, our understanding of such factors as why it occurs when it does (i.e., whether it is a nocturnal or diurnal behavior), and the roles played by (e.g., emotion, cognition, and environment) remains imperfect. This section reviews literatures examining the question of what is wandering, how prevalent is wandering, and what are the relating factors of wandering.

What Is Wandering

The term "wandering" has been used to describe dementia-related problematic locomotion. However, many studies seeking to define or classify wandering have been based on subjective interpretations (Scarmeas, et al., 2007). Since wandering is a complex behavior, a precise, standardized definition of wandering is required if one hopes to generalize wandering-related research and implement interventions for wanderers. This section covers the following four parts: (1) wandering differentiated from other phenomena; (2) definitions of wandering; (3) wandering patterns and typologies, and (4) measures for wandering.

Wandering differentiated from other phenomena. Several studies used the operational definition of "wandering" included other behaviors such as agitation or restlessness without discrimination. Linton and colleagues defined wandering operationally as observed agitation or restlessness in walking, standing or pacing (Linton, Matteson, & Byers, 1997). Swearer and colleagues defined wandering as aimless walks without guidance, frequently away from where the wanderer should have been (Swearer, Hoople, Kane, & Drachman, 1996). The operational definition of wandering used by Scarmeas and colleagues was considering away from home or from the caregiver (Scarmeas, et al., 2007). Other authors, however, have emphasized wandering behaviors, such as agitation or hyperactivity (Cohen-Mansfield, 1986). According to Cohen-

Mansfield (1986), agitation is “inappropriate verbal, vocal or motor activity which is not explained by needs or confusion *per se*.” (p. 712). As a type of agitation, physically non-aggressive behaviors include pacing or wandering.

Importantly, Algase and colleagues (2008) examined whether wandering and physically nonaggressive agitation (PNA) are made up of similar structures. Factor analyses indicated that while wandering is a coherent structure, PNA has two factors: factor 1 includes pacing/aimless wandering, trying to get to a different place and handling things inappropriately; and factor 2 contains general restlessness, repetitive mannerisms, and inappropriate dressing/disrobing (Algase, et al., 2008). Thus, findings have shown wandering and PNA to be overlapping but nonequivalent phenomena (Algase, et al., 2008).

As for restlessness, this factor was defined as “a discontinuous animal behavior evidenced by non-specific, repetitive, unorganized, diffuse, apparently non-purposeful motor activity that is subject to limited control” (Norris, 1975, p. 107). Through literature reviews, Kolanowski presented two critical attributes of restlessness: (1) diffuse motor activity that is prompted by, or in response to changes, which are arousing or challenging; and (2) perception of these changes as either arousing or challenging (Kolanowski, 1991, p. 350). Some features of restlessness have been found to overlap with wandering behavior.

However, Algase et al. (2007) clearly differentiates wandering, agitation, and restlessness. These three phenomena share some characteristics (i.e., motor behavior), but each behavior has at least one unique characteristic. More specifically, characteristics of wandering are frequently repetitious, temporally-disordered, and spatially-disordered, spatially-disordered cognition, sensory/ perceptual deficits, and the underlying states being need-driven. Yet, agitation is characterized by behaviors that are nonproductive, repetitious, and inappropriate to the circumstance with underlying states being inner tension, discomfort or discontent. Restlessness is nonproductive, unorganized, diffuse, and progressive; potential underlying states of restlessness include heightened arousal, suboptimal stimulation, and anticipatory affect (Algase, Yao, Beel-Bates, & Song, 2007).

In addition, it is necessary to distinguish between wandering and elopement, and between agitation and restlessness. Elopement, "the act of wandering away from a safe residence", is dangerous and difficult to predict (Aud, 2004, p. 362). However, wandering has been found to have very little relationship to leaving or being brought back home (Hope, et al., 1994), while elopement is a potentially hazardous consequence of wandering. Thus, wandering is not necessary to connect with elopement (Lai & Arthur, 2003) or vice versa.

In sum, wandering as a locomotion behavior overlaps with some of the characteristics of dementia-associated behaviors, such as agitation, restlessness, and elopement. However, wandering has unique features such as (1) repetitiveness and (2) origin—usually from some disturbed, destabilized, or unsatisfied internal state, condition, or need (Algase, et al., 2007).

Definitions of Wandering. An early definition of wandering described it as aimless or disoriented movement (Albert, 1992; Dawson & Reid, 1987; Namazi, Rosner, & Calkins, 1989; Synder, Rupprecht, Pyrek, Brekhus, & Moss, 1978). Later, wandering was viewed as not only being aimless, but also described as having purposeful intent (Coons, 1988; Hall, 1990; Rader, Doan, & Schwab, 1985). However, some consistency was found in the literature. Theoretical or operational definitions of wandering are depicted in Table 2. 1.

Several studies have examined various aspects of wandering behaviors. The community-based study by Hope and Fairburn (1990) showed wandering includes a wide range of distinct behavioral abnormalities having five fundamental components: (1) compromised extensive walking activity; (2) avoidance of being alone; (3) diurnal rhythm disturbance; (4) navigational ability; and (5) faulty goal-directed behavior (p. 244). Thomas (1995) described wandering in this way: "a purposeful behavior that attempts to fulfill a particular need (from the context of the wanderer), is initiated by a cognitively impaired and disoriented individual and is characterized by excessive ambulation that often leads to safety and/or nuisance-related problems" (p. 37).

In a study that examined empirical findings of 108 studies, Algase (1999a) concluded that wandering is ambulating behavior of PWD which consists of five dimensions: (1) it occurs in large volume, that is at a high frequency or to great extent; (2) it has a seemingly aimless, lapping, or random quality or pattern; (3) it exceeds or transgresses environmental limits; (4) it reflects spatial disorientation or navigational deficits that may result in the wanderer getting lost, having difficulty following old routes, or shadowing others; and (5) it has a time-based dimension, viz., it tends to occur more during the day than at might, or vice versa (p. 188).

For the clinical purposes, the North American Nursing Diagnosis Association (NANDA) (2001) suggested that wandering has certain defining characteristics. These include frequent or continuous movement from place to place; frequent (but not invariable) return to the same destinations; periods of locomotion or persistent locomotion; haphazard locomotion; locomotion into unauthorized areas or locomotion resulting in unintended departure from premises; long periods of locomotion without an apparent destination or end point; fretful locomotion or pacing; an inability to locate significant landmarks in a familiar setting; and locomotion that cannot be easily deterred or redirected (North American Nursing Diagnosis Association, 2001).

For the operational definition of wandering, a large number of studies have used the Minimum Data Set (MDS) to capture wandering behavior (Kiely, et al., 2000; Schonfeld, et al., 2007). *The MDS Procedural Manual* has defined wandering as "locomotion with no discernible, rational purpose" (Schonfeld, et al., 2007, p. 694). Both the MDS conceptualization of wandering and the definition found in earlier research are broad and outdated (Molinari, King-Kallimanis, Volicer, Brown, & Schonfeld, 2008).

Most recently, a new, valid, and comprehensive definition of wandering has been developed. Following their review of 183 journal articles called from multiple databases, scientists of the International Consortium on Wandering Research (Algase, Moore, Vandeweerd, Gavin-Dreschnack, & Moore, 2007) proposed the following definition of dementia-related wandering:

> A syndrome of dementia-related locomotion behavior having a frequent, repetitive, temporally-disordered and/or spatially-disoriented nature that is manifested in lapping, random and/or pacing patterns, some of which are associated with eloping, eloping attempts or getting lost unless accompanied (p. 696).

This definition covers not only various domains of wandering but also serves as a guideline for clinical practice and research goals. Therefore, this study used the definition of dementia-related wandering proposed above in defining wandering behaviors.

Table 2.1. Definition of Wandering in Literature

Author	Definition
Cornbleth, 1977	aimless or disoriented movement
Synder et al. 1978	Tendency to move about, either in a seemingly aimless or disoriented fashion, or in pursuit of an indefinable or unobtainable goal
Dawson and Reid, 1987	Frequent and/or unpredictable pacing with no discernible goal
Coon, 1988	Ambulation that is self-initiated and occurs independently of environmental cues, such as the ringing of a bell for meal time, or an invitation by staff to take part in an activity
Namazi et al. 1989	Seemingly aimless or disoriented movement that involves exiting a protected Alzheimer's unit to go outdoors
Hall 1990	Both purposeful intent and aimlessness
Hope and Fairburn, 1990	Five components of particular importance to range of behavior; 1) overall degree of walking activity; 2) avoidance of being alone; 3) diurnal rhythm disturbance; 4) compromised navigational ability; and 5) faulty goal-directed behavior
Albert 1992	Purposeless behavior
Thomas, 1995	A purposeful behavior that attempts to fulfill a particular need (from the context of the wanderer), initiated by a cognitively impaired and disoriented individual and characterized by excessive ambulation that often leads to safety and/or nuisance-related problems
Swearer, et al., 1996	Aimless walks without guidance, frequently away from where the wanderer should be
Algase, 1999	Ambulating behavior of PWD which has five dimensions: 1) it occurs at a high frequency, rate, or for a high degree; 2) it displays a seemingly aimless, lapping, or random quality or pattern; 3) it exceeds or transgresses environmental limits; 4) it reflects spatial disorientation or navigational deficits, such as getting lost, being impaired in learning new or following old routes, and shadowing others; and 5) it has a time-based dimension, i.e., it tends to occur during certain hours of the day or night
Kiely et al, 2000	Locomotion, excluding pacing, with no discernible or rational purpose, which should be differentiated from purposeful movement (e.g., a hungry person moving about his or her unit in search of food)

NANDA, 2001	Frequent or continuous movement from place to place; frequent (but not invariable) revisiting of the same destinations; periods of locomotion or persistent locomotion; haphazard locomotion; locomotion into unauthorized areas or locomotion resulting in unintended leaving of premises; long periods of locomotion without an apparent destination or end point; fretful locomotion or pacing; inability to locate significant landmarks in a familiar setting; locomotion that cannot be easily deterred or redirected
Algase et al., 2007	A syndrome of dementia-related locomotion behavior having a frequent, repetitive, temporally-disordered and/or spatially-disoriented nature that is manifested in lapping, random and/or pacing patterns, some of which are associated with eloping, eloping attempts, or getting lost unless accompanied.
Schonfeld et al., 2007	Locomotion with no discernible, rational purpose
Scarmeas, et al., 2007	Locomotion away from home or from the caregiver
Molinari et al., 2008	Locomotion with no discernible, rational purpose

Patterns and typologies. As seen, since wandering itself is a multifaceted phenomenon, some different patterns have been observed regarding wanderers. Patterns and typology were reviewed in this section. Various attempts have been made to classify wandering behaviors with early classifications of wandering centering on specific behaviors such as exit-seeking or self-stimulators (Hussain, 1985), or the perceived motives of wanderers, including reminiscence and fantasy recreation (Hall, 1990).

Martino-Saltzman et al. (1991) characterized four patterns of independent travel: direct (travel from one location to another without diversion); random (roundabout or haphazard travel to many locations within an area without repetition); pacing (repetitive back-and-forth movement within a limited area); and lapping (repetitive travel characterized by the circling of large areas). The methodology of Matino-Saltzman was used by Algase and colleagues in conducting several studies of wandering (Algase, Beattie, Bogue, et al., 2001; Algase, Beattie, & Therrien, 2001; Algase, et al., 1997).

Thomas (1995) suggested using the quantitative variable of "time-in-motion" to distinguish two broad categories of wanderers: (1) continuous wanderers, and (2) sporadic wanderers (p. 37). "Continuous wanderers" are those who ambulate for more than 50% of their wakeful-time, while "sporadic wanderers" are those who move about less than half of their wakeful-time. However, Thomas failed to show empirical data to support categories of wanderers, and also failed to differentiate ambulation that constitutes wandering from that which may be functional or normal. Hope and Fairburn (1990) proposed nine types of wandering behaviors derived from the wandering section of the investigator-based interview, Present Behavioral Examination (PBE): increased walking; attempting to leave home; being brought back home; trailing; aimless walking; pottering; inappropriate walking; excessive appropriate walking; and night-time walking. It is clear that the term 'wandering' has been used to cover a wide range of quite different kinds of behavior.

Recently, a study developed a wandering typology with a personal rather than an episodic focus (Algase, Antonakos, Beattie, Beel-Bates, & Yao, 2009). Based on rate and duration of their wandering, three groups of wanderers were identified through cluster analysis as either classic, moderate, or subclinical. Of these three groups, "classic wanderers" exhibited the highest wandering rate and duration, the most severe cognitive impairment, and the greatest mobility. One of the unique findings of this study is that this group showed more severe heart problems than other wanderers. "Moderate wanderers" had both lower wandering rates and duration than did classic wanderers, and although they had better cognitive function than classic wanderers, they had poorer mobility. They were also the healthiest of the three groups. Finally, "sub-clinical wanderers" showed the lowest wandering rates and duration among these three groups. They had the highest cognitive function among wanderers, and mobility functions similar to those of moderate wanderers. They were healthier than classic wanderers, but not as healthy as moderate wanderers. This typology is useful especially for describing wandering at the personal level, which contributes to be a better understanding of wandering etiologies, a more accurate evaluation of potential genetic contributions to wandering, and the implementation of more accurate targeting interventions (Algase, Antonakos, Beattie, Beel-Bates, et al., 2009).

Measures for wandering. Given the range of definitions of wandering, quantifying wandering is essential to understand wandering behavior. However, measurement of wandering behavior is a challenge because wandering has been shown to be a complex and multifaceted behavior. Moreover, most studies have measured wandering as a dichotomous variable, e.g., present one either or absent. Several methods have been used to measure wandering; these have included (1) rating scales/checklists, (2) direct/indirect observation, and (3) biomechanical devices.

Rating Scales/Checklists. One of the most frequently used measurements of wandering employs rating scales/checklists. Structured interview or rating scales offer the advantage of being time efficient, and they show high internal reliability (Hope & Fairburn, 1992). A large number of studies have used the MDS, the standard rating tool for assessing nursing home resident functioning; its use is required by the Center for Medicaid and Medicare Services. The MDS is also part of the mandatory resident assessment instrument by which all nursing homes in the United States are evaluated (Morris, et al., 1990). Within MDS 2.0 Section E-4, all behavioral symptoms are rated on two criteria. The first, “symptom frequency in last 7 days,” has four possible ratings: not exhibited; occurred 1 to 3 days; occurred 4 to 6 days, but less than daily; and occurred daily. The second criterion is “symptom alterability in last 7 days,” with a behavior rated either “not present or … easily altered” or “not easily altered” (Morris, et al., 1990, p. 295). Most studies have used the first criterion to define wanderers (Morris, et al., 1990). Thus, information on wandering of the MDS is very limited because it only measures the presence of wandering but not types and length of wandering.

In addition, several rating scales/checklists have measured wandering as only minor behavioral component; examples include the Dementia Behavior Disturbance scale (DBD), the Neuro-Psychiatric Inventory (NPI), and the Cohen-Mansfield Agitation Inventory (CMAI). The DBD scale was designed to quantify specific problematic behaviors usually associated with dementia; it was based on an interview with the patient’s primary caregiver (Gauthier, Baumgarten, & Becker, 1996). Among the items listed on the DBD scale, some are associated with wandering behavior: pacing up and down; wandering in the house at night; and wandering aimlessly outside or in the house during the day. Gauthier and colleagues (1996) reported a fairly high internal consistency coefficient, with moderate test-retest reliability.

The NPI is a set of the useful assessment rating scales of behavioral and psychiatric symptoms reported by caregiver-informants of patients experiencing mild, moderate, or advanced dementia. Among 12 neuropsychiatric symptoms, aberrant motor behavior— purposeless, repetitive behavior, including pacing or wheeling, putting on and taking off clothing, moving objects back and forth, folding and unfolding linens, winding string, or picking at things on clothing, — describes some facets of wandering behaviors.

The NPI has been shown to be a valid and reliable instrument in the outpatient setting (Cummings, et al., 1994). However, because the NPI did not directly evaluate participants, relying instead on information obtained from an informant interviews, results may have been at variance with a clinical diagnosis based on the presence of neuropsychiatric symptoms displayed. It is also difficult to measure wandering independently.

The CMAI is a 36-item instrument used to assess the nature and frequency of agitation in nursing home residents, including those with dementia. Both wandering and pacing are items contained within the physically nonaggressive subtype of agitation. Internal consistency, reliability, and validity of the CMAI have been established (Finkel, Lyons, & Anderson, 1992). However, psychometrics of the DBD scale, the NPI, and the CMAI specifically for wandering is unknown.

The Present Behavioral Examination (PBE) was developed as an investigator-based interview for assessing the current behavior of people with dementia (Hope & Fairburn, 1992). Among eight behavioral domains of dementia-related behavior, the walking domain includes 11 types of wandering behaviors. Inter-rater reliability for the walking domain was reported as having mean kappa scores of .77and .48 when used with two independent samples, N=40 and N=39, respectively (Hope & Fairburn, 1992).

One rating scale/checklist was designed specifically for wandering. The Algase Wandering Scale (AWS) incorporating five dimensions of wandering behavior was derived from a thorough analysis of the literature (Algase, Beattie, Bogue, & Yao, 2001). The AWS is a 28-item caregiver questionnaire addressing a wide range of wandering characteristics; these include frequencies, patterns, boundary transgressions, navigational deficits, and temporal aspects. Internal consistencies for these subscales are between .83 and .94; test-retest reliability correlations were between .61 and .70 for the same subscales. The AWS has been rigorously evaluated as a research instrument (Lai & Arthur, 2003).

Direct/Indirect Observation. A considerable number of studies have obtained data by direct or indirect observation of participants. Several researchers used direct observation coupled with a variety of behavior mapping techniques (Cohen-Mansfield, Werner, Marx, & Freedman, 1991; Matteson & Linton, 1996; Synder, et al., 1978). Matteson and Linton (1996) developed an instrument to record data measuring characteristics associated with wandering, gathered from 49 special care unit residents. Each subject was tracked by a trained observer, and patterns of behavior were logged through observation of all daily activities. The behaviors were grouped into six categories: activity (e.g., lying or sitting); location (e.g., own room or dining room); behavior (e.g., sleeping, pacing, or looking); verbalizing (talking or screaming); activities of daily living (e.g., bathing or toileting); and formal activities (e.g., music or nature walks) (Matteson and Linton, 1996). Inter-rater reliability was reported as having mean kappa scores of .79. Employing rhythm theory, Algase and colleagues have also used an observational methodology in several studies (Algase, Beattie, Bogue, et al., 2001; Algase, Beattie, & Therrien, 2001; Algase, Kupferschmid, Beel-Bates, & Beattie, 1997). Indirect observations involved scanning a bar code from a list or operating a monitoring camera. These methods have the advantage of yielding a more exact measure of the frequency, duration, and patterns of wandering.

Although all or the above studies used repeated observations to focus on overall frequency, timing, or problematic types of wandering, a recent study depicted characteristics of wandering in real time (Algase, Antonakos, Beattie, & Beel-Bates, 2009). While observations were like Algase's prior studies, videotaped, coded rate and duration of wandering episodes were calculated and plotted to derive new parameters for values above and below case medians regarding proportion of hours spent wandering, and time of day (Algase et al, 2009).

While observational approaches provide a better picture of wandering than rating scales or checklists (Algase, 1999a), they require a great deal of time to capture enough behavioral events to justify any attempt at analysis, and observer training is required. In general, observational approaches can provide researchers with potentially the most objective information about wandering in natural contexts. This study measured wandering to use an observational approach.

Biomechanical Devices. Use of biomechanical devices offers the benefit of cost savings and the elimination of rater bias or interpretation (Cohen-Mansfield, Werner, Culpepper, Wolfson, & Bickel, 1997). Unsurprisingly, biomechanical devices have, therefore, been used to measure wandering behaviors.

A study was conducted in which four biomechanical devices were used to monitor ambulatory nursing home residents (Algase, et al., 2003). The four devices were the the Actillume; the TriTrac-R3D; Step Sensor; and the StepWatch. The Actillume (Ambulatory Monitoring, Inc., Ardsley, NY) is an accelerometer using a piezoelectric sensor that measures movement in three planes. The TriTrac-R3D (Hemokinetics, Madison, WI) is an improved version of the CalTrack (Glass Lantern, LLC, Washington

DC) used in estimating physical activity levels. The Step Sensor (Motion Research of Iowa, Inc.) is a step counter worn in the shoe under the heel. Finally, the StepWatch is a step counter that fits the lower calf with two elastic straps. The StepWatch has a higher validity than other devices because it explains more than two and one-half times the variance in proportion of time spent wandering (Algase, et al., 2003). Among these four devices, this study rated the StepWatch as the best overall device for measuring wandering (Algase, et al., 2003).

Miskelly (2004) tested a novel system—derived from prisoner tagging systems—that electronically tagged patients with dementia (Miskelly, 2004). This system used a single bracelet containing a small radio transmitter; one roll of recording paper; and one recording monitor. The system proved to be very reliable, successfully detecting two incidents of external wandering; in addition, compliance was excellent.

Recently, Radio Frequency Identification Devices (RFID) and Global Positioning Systems (GPS) have been used to measure wandering. In RFID systems, patients are fitted with tags or bracelets that trigger selective lockdown when an exit attempt occurs; GPS is usually applied to outdoor monitoring (Moore & French, 2007). These systems track patients' movements. In addition, Ultra Wideband (UWB) RFID, a variant of RFID, is regarded as an ideal way to study shadowing and lingering wandering behaviors, because it can display the identities and precise locations of several people simultaneously (Glabman, 2004; Kearns & Moore, 2008). The UWB-RFID systems operate on narrow bands of the radio spectrum, and UWB signal transmission times are much shorter than conventional RFID transmissions. Kearns and his team (2008) conducted lab-based experiments; their results suggest that UWB-RFID technology is sufficiently reliable and accurate to measure lingering and shadowing. This valid and reliable new technology can be used to measure wandering of people with dementia later if this technology also validates other types of wandering such as pacing, lapping, or randon. In particular, it could provide data regarding the antecedents and consequences of wandering, as it can relay a wanderer's spatial or geographic relationship to care setting exit points (Kearns & Moore, 2008).

Among three measures for wandering, this study used an observational approach because this approach provides not only enough behavioral events but also objective information.

Prevalence of Wandering

Estimates of wandering prevalence are not consistent, due to methodological differences across studies (Burns, Jacoby, & Levy, 1990). The prevalence, estimated from cross-sectional studies of community samples, varies widely from 17% to 65% (Cohen-Mansfield, 1986; Hope, et al., 2001; Klein, et al., 1999). A ten year, longitudinal study conducted by Hope et al. (2001), described the prevalence of nine specific wandering behaviors for 86 community-dwelling people with dementia. The prevalence of these behaviors varied from 7% (excessive appropriate walking) to 56% (night-time walking); the next most common behaviors displayed were aimless walking (50%) and attempts to leave home (46%). At the beginning of this study, prevalence was 21% for severe types of wandering, and 33% for milder types. For those followed until death (n = 75), 80% still had at least one severe, persistent, or increased wandering behavior with an average of 3.2 such behaviors reported. However, estimation of wandering behaviors may be low since caregivers were changed, and the freedom to wander may be restricted when participants are institutionalized. Taken together, the prevalence estimates of wandering are rough and widely variable.

Factors That May Influence Wandering Behavior

Even though the etiology of wandering has been elusive, many studies have examined potential correlating factors. The Need-Driven Dementia-Compromised Behavior (NDB) Model was synthesized from empirical studies to provide a comprehensive picture of factors affecting a range of behaviors that accompany dementia (Algase, et al., 1996). The model posits two groups of interacting factors that result in wandering behaviors: background and proximal. Background factors are those things about an individual that are unchanging or are, at least, relatively stable over the short term; proximal factors are those things about an individual or the environment that may change in a matter of minutes (Algase, 1999c). This section examines background and proximal factors that may affect the wandering behavior of people with dementia.

Background factors. Background factors consist of cognitive factors, general health, personal characteristics, and sociodemographics. Cognitive factors are separately examined in a later section (i.e., cognition in dementia).

General health. General health refers to a person's overall condition. It can be measured by comorbidity, motor ability, Activity of Daily Living (ADL), and Instrumental Activity of Daily Living (IADL). Few articles have captured the relationship between wandering and general health. Decline in motor ability is likely to preclude or severely reduce wandering (Tinetti, 1986, 1987). Schonfeld and colleagues (2007) reported that wanderers were more likely to be dependent in personal hygiene, but independent in ambulation. However, results from a prospective study in France showed that no differences between wanderers and non-wanderers were found by nutritional status, weight, and ADL after controlling for baseline characteristics (Rolland, et al., 2007).

Personal characteristics. Studies have also examined the relationship between premorbid characteristics and wandering behaviors. One study of nursing home residents suffering from dementia found no significant correlations between wandering behaviors and premorbid lifestyles before getting dementia that included leisure activities, hobbies, exercise, and stress management, regardless of those residents' type of employments or degree of social interaction. (Linton, et al., 1997).

Several other studies have found significant relationships between premorbid personality traits and wandering behavior. Several studies have shown that wanderers have more extroverted personalities than non-wanderers (Kolanowski & Litaker, 2006; Monsour & Robb, 1982; Thomas, 1997). However, a recent study reported different results. One study explored the relationship between premorbid personality and behavioral to stress response and wandering behavior in persons with dementia in long-term care facilities using the NEO Five-Factor Personality Inventory, the Behavioral Responses to Stress, and the Revised Algase Wandering Scale Nursing Home Version (RAWs-NH) (Song & Algase, 2008). The results showed that premorbid extroverted personality and premorbid negative verbalization stress response were significant negative predictors of wandering behavior after controlling for age and MMSE scores. Thus, while premorbid personality traits are one of the important background factors affecting wandering behavior, the exact relationship between personality traits and wandering behavior remains debatable. One potential reason for this difference may be the application of different methodologies (Song & Algase, 2008). Although Song & Algase (2008) examined wandering as a continuous variable and measured multiple dimensions of wandering, other researchers examined wandering as a dichotomous variable and measured one aspect of wandering (Monsour & Robb, 1982; Thomas, 1997).

Sociodemographics. The relationship between demographic characteristics and wandering is somewhat mixed. A longitudinal study reported changes in wandering behavior were not generally correlated with gender or age (Hope, et al., 2001). A study in Taiwan reported that no significant differences were found between wanderers and non-wanderers in terms of age, sex, years of education, and their age at onset (Yang, Hwang, Tsai, & Liu, 1999). Several studies also showed sex, age, and race are not correlated with being a wanderer (Holtzer, et al., 2003; Teri & Gallagher-Thompson, 1991). On the other hand, Lai and Arthur (2003) reported that a typical wanderer within the older population was relatively young and a male (Lai & Arthur, 2003). However, researchers disagree about the relationship between sociodemographic variables and wandering because sample size of studies was relatively small and no randomized controlled trials were found.

Proximal factors. According to the NDB model, proximal factors are those things about an individual or the environment that are relatively dynamic (Algase, 1999b). For example, a person with dementia may wander because he is thirsty and in search of water. Proximal factors include physiological need states, emotions, and social and physical environment. Emotions are identified in a later section.

Physiological need states. Lucero suggested wandering behavior may be prompted when someone suffering from dementia experiences physical discomfort brought , for example, by hunger, thirst, cold, fatigue, or pain (Lucero, 2002). Several studies examined the association between wandering and physiological need states such as hunger, thirst, pain, and elimination. Results of data gathered from 8982 subjects, using the Minimum Data Set showed that nursing home residents with dementia, who were constipated (OR=1.82), or expressed pain (OR=1.65) were at increased risk of developing wandering behavior, compared to residents who lacked these need states (Kiely, et al., 2000). Cipher, Clifford, & Roper (2006) also showed higher pain levels to be associated with both higher behavioral intensity and frequency, and more dysfunctional behaviors. Interestingly, a study examined behavioral associates of reported excessive eating (Smith, Vigen, Evans, Fleming, & Bohac, 1998), which was found to be associated with significantly a higher frequency of wandering, which affected 49% of excessive eaters, but only 22% of other patients with dementia. Thus, the research has shown a relationship between physiological needs and wandering.

Social and physical environment. Social interactions also play an important role, as isolation is associated with wandering (Cohen-Mansfield, Marx, Werner, & Freedman, 1992; Synder, et al., 1978). Several intervention studies have reported increasing staff-resident interactions to be an effective wandering intervention. One study found that increasing the amount of time staff spend interacting with residents reduces wandering behavior (Goldsmith, Hoeffer, & Rader, 1995). Similarly, Okawa et al. (1991) showed that increasing social interaction with nurses effectively reduces wandering in 30% of dementia patients who display wandering behaviors. Additionally, a cross-sectional study using a retrospective review of MDS data obtained nationally from the Veterans Affairs (VA) nursing home care units has shown that wanderers are more likely to exhibit socially inappropriate behavior (OR=4.88) and resistance to care (OR=3.76) (Schonfeld, et al., 2007).

Environmental characteristics (e.g., ambient noise, lights, wall patterns, floor patterns, and temperature) affect behavioral symptoms (Kunik, et al., 2003). In general, wandering seems to increase when the environment is not familiar (Cohen-Mansfield & Werner, 1995; Cohen-Mansfield, et al., 1991), although it decreases when a subject is alone (Cohen-Mansfield & Werner, 1995). A recent study reported that engaging and soothing environments tend to encourage sitting, and discourage walking, among people with dementia (Yao & Algase, 2006). Algase and her colleagues (2010) showed that wandering is related to brighter lights, greater variation in sound levels, more engaging surroundings, and less soothing surroundings. In addition, wanderers were found to be more likely to wander in 4 locations (i.e., other residents' room, hallway, shower/bath, and off-unit location) than in an activity room, a dining room, a dayroom, their own room or a staff area (Algase, Beattie, Antonakos, Beel-Bates, & Yao, 2010).

Alarms and security systems are frequently used to deal with safety problems created by wandering (Hewawasam, 1996). However, a recent Cochrane review found little evidence so far to conclude that subjective barriers (e.g., mirrors, camouflage, grids/strips of tape) prevent wandering because existing studies lack adequate controls and are vulnerable to bias (Price, Hermans, & Grimley Evans, 2009).

Summary

Wandering in dementia is a multifaceted phenomenon; it is not surprising, then, that the research has yet to explain fully what factors affect it, and which mechanisms might explain it. Recently, however, the International Consortium group on Wandering Research developed a solid definition to cover various aspects of wandering, and a large number of studies have been conducted to find correlates of wandering. As the volume of research has increased, so has precision of the measuring the phenomenon of wandering. Although some aspects of wandering are now well clarified, causes of wandering are still uncertain. Emotion and cognition are among the causes of wandering mentioned, which merit greater attention. Thus, the next chapters review emotion and cognition in people with dementia, and the relationship of these factors to wandering.

Emotion in Dementia and Wandering Behavior

As one of the proximal factors of the NDB model, emotion has been addressed as a contributing factor to the wandering behaviors of people with dementia. However, research has focused primarily on biological factors; little regard has been paid to the fact that those suffering from dementia are also human beings who feel, wish, and think (Norberg, 1996). In recent years, the study of emotion in people with dementia has become an active area of inquiry because these emotions come into play in the delivery of patient care (Finnema, et al., 2005). A greater understanding of the emotions of those with dementia could result in improved treatment, such as adaptation of a behavioral modification intervention of PWD that is sensitive to patients' feelings. Thus, this section presents a literature review addressing what emotion is, what emotion for those suffering from dementia is, the relationship between emotion and wandering, and how emotion is measured.

What Is Emotion?

Definition of emotion. The need to define emotion has often been acknowledged by psychologists. Although many efforts have been made, a universal definition of the term has not been adopted (Izard, 2006; Pankesepp, 2003). Furthermore, basic concepts of emotions such as fear and anger have not been thoroughly analyzed, due to their complexity (Russell, 1991); exactly equivalent words for these concepts do not exist in all languages (Russell, 1991). Because there is no consensual conceptualization of exactly what it is that constitutes emotion, it is difficult to conduct research on the topic. This section presents the definitions of emotion used in literature.

In 1884, James first offered his theory of emotion, which was later called James-Lange theory. According to James-Lange theory, emotion is described as “bodily changes that follow directly the perception of an exciting fact” and “our feeling of the same changes as they occur” (James, 1884, p. 189-190). Similarly, Cannon defined emotions as physiological responses in subjects (Cannon, 1927). Following Cannon, several authors have viewed emotion as primarily affective or physiological responses. Schachter and Singer defined emotion as “a state of physiological arousal and of cognition appropriate to this state of arousal” (Schachter & Singer, 1962, p. 380). Morris (1979) defined an emotion as “a complex affective experience that involves diffuse physiological changes which can be expressed overtly in characteristic behavior patterns” (Morris, 1979, p. 386).

Therefore, these authors emphasized feeling, cognitive, and internal physical mechanisms of emotions.

On the other hand, many definitions emphasize the multi-dimensional nature of emotions. Definitions of emotion have commonly included affective, cognitive, physiological, and emotional/expressive behavior (Kleininginna & Kleinginna, 1981). Lazarus defined emotion as a complex disturbance that induces three main components: "subjective affect, physiological changes related to species-specific forms of mobilization for adaptive action, and action impulses having both instrumental and expressive qualities. The quality and intensity of the emotion and its action impulse all depend on a particular kind of cognitive appraisal of the present or anticipated significance of the transaction for the person's well-being" (Lazarus, 1975, p. 554). However, very few definitions of emotion characterize it as a state of disturbance of the individual (Kleinginna & Kleinginna, 1981).

More recently, Plutchik, synthesizing of 28 definitions of emotion, defined it in the following way: (1) emotions are generally aroused by external stimuli; (2) emotional expression is typically directed toward the particular stimulus in the environment by which it has been aroused; (3) emotions may be, but are not necessarily or usually, activated by a physiological state (e.g., skin conductivity, muscle tension); (4) there are no 'natural' objects in the environment (like food or water) toward which emotional expression is directed; and (5) an emotional state is induced after an object is seen or evaluated, and not before (Plutchik, 1980). This definition was derived from a comprehensive analysis of definitions of emotion, but was not specific enough to provide a distinction between emotion and other states or processes, such as mood and internal emotional mechanisms (Kleinginna & Kleinginna, 1981); it emphasizes external emotional triggers, but these catalysts may not always be present, since interoceptive stimuli, too, may produce emotional responses (Gazzaniga, Steen, & Volpe, 1979).

Furthermore, following their review of 92 definitions and 9 skeptical statements taken from a variety of sources in the literature of emotion, Kleininginna & Kleinginna (1981) proposed a formal definition, which included many possible aspects of emotion:

> Emotion is a complex set of interactions among subjective and objective factors, mediated by neural/hormonal systems, which can (a) give rise to affective experiences such as feelings of arousal, pleasure/displeasure; (b) generate cognitive processes such as emotionally relevant perceptual effects, appraisals, labeling processes; (c) activate widespread physiological adjustments to the arousing conditions; and (d) lead to behavior that is often, but not always, expressive, goal directed, and adaptive (p. 355).

Despite its wide scope, this definition of emotion not only includes its traditionally important aspects but also differentiates it from other psychological processes.

Later, based on the four-dimensional experience that includes quality, intensity, hedonicity, and duration, Cabanac proposed that "emotion is any mental experience with high intensity and high hedonic content" (Cabanac, 2002, p. 69). More recent research by Scherer suggests that the definition of emotion employ a different approach, one being equivalent to the design features described by Hockett (Scherer, 2005). Hockett, an anthropological linguist, attempted to define 13 elementary design features of communication systems, including semanticity, arbitrariness, and discreteness that can be used in profiling different types of communication; these features, he argued, maybe it possible to specify the unique nature of language (Hockett, 1960). If one were to use the above features, emotion would be described as (1) somehow connected to an external or internal specific event; (2) relevant to major concerns of the organism; (3) preparing appropriate responses to events; (4) having a strong effect on emotion-consequent behavior; (5) having relatively short duration; (6) having relatively high intense response patterns and corresponding emotional experiences; and (7) being likely to change rapidly (Scherer, 2005).

To sum up, definitions reviewed here show various characteristics of emotion. Using these definitions of emotion, we can construct theories about, and engage in research focused on emotion.

Types of emotion. Although emotion equally comprises a number of discrete emotions which differ one from another, in important ways, there is disagreement over how many different emotion exist (Ekman, 1992; Scherer, 2005). However, a number of psychologists agree that there are certain basic emotions they recognize. The term "basic emotion" refers to "any emotion that is assumed to be fundamental to human mentality and adaptive behavior" (Izard, 2009, p. 7). Basic emotions, also called universal or innate emotions, are biologically determined (Darwin, 1965) and tend to occur for all human beings, regardless of their culture (Allport, 1924).

Employing a definition utilizing the above agreed characteristics, several psychologists have suggested which emotions may properly be deemed basic. According to Izard (2007), all people, including the most rigorous behavioral scientists, recognize such basic emotions as joy, sadness, anger, fear, and shame. Similarly, Ekman (1992) proposed that there is consistent evidence of universal facial expressions for anger, fear, enjoyment, sadness, and disgust. Russell (1991) reported that emotion is divided into two-dimensional structure including positive vs. negative emotion. This study will use this two-dimensional view of emotion.

Associated phenomena. It is difficult to differentiate emotion from other similar phenomena such as feeling, mood, and affect, since those words have been frequently used interchangeably. Although there may be some overlap in the meaning of such terms, it is important to clarify the distinction between emotion and other affective phenomena because conceptual clarity is a foundation of science and research. In this section, distinctions between emotion and other affective phenomena—feeling, mood, and affect— are discussed.

Feeling is defined as “a subjective cognitive representation, reflecting a unique experience of mental and bodily changes in the context of being confronted with a particular event” (Scherer, 2005, p. 712). Fish also regarded feelings as the subjective experience of emotion (1974). Damasio (2001) clearly stated that emotion and feelings are closely related but separable phenomena. If emotions are an organism’s immediate response to certain challenges and opportunities, the feeling of those emotions serves as a mental alert (Damasio, 2001). Thus, feeling is not equivalent to emotion; rather, the former is component of the latter.

Another emotion-associated phenomenon is mood. Mood has been described as the “emotional state prevailing at any given time” (Hamilton, 1985, p. 70). In general, moods are considered to be “diffuse affect states characterized by a relatively enduring predominance of certain types of subjective feelings affecting a person’s experience and behavior” (Scherer, 2005, p. 705).

In order to better differentiate between emotion and mood, Beedie and colleagues investigated emotion-mood distinctions among a non-academic population and compared these finding with distinctions proposed in the literature (Beedie, Terry, & Lane, 2005). Non-academic participants (i.e., lay people) identified 16 distinctions, with cause (65%), duration (40%), control (25%), experience (15%), and consequences (14%) being the most frequently cited. Authors in the academic literature (i.e., published works from the psychology, psychiatry and philosophy literature) proposed eight distinctions, with duration (62%), intentionality (41%), cause (31%), consequences (31%), and function (18%) being the most frequently cited. Although themes cited by non-academics and academics are different, approximately 60% of these themes overlap. Both non-academic and academic views generally hold that emotions are more intense, brief, and volatile than moods (Beedie, Terry, & Lane, 2005). Additionally, emotion is less controllable than mood.

The last of the three affective phenomena is affect. The words "affect" and "emotion" have been used interchangeably; affect-emotion distinctions are still blurred. Important attempts have been made by well-known neuropsychologists to provide terminological clarifications between emotion and affect.

Panksepp (2000), for example, has suggested the following taxonomy:

> Emotion is the "umbrella" concept that includes affective, cognitive, behavioral expressive, and a host of physiological changes. Affect is the subjective experiential-feeling component that is very hard to describe verbally, but there are a variety of distinct affects, some linked more critically to bodily events, others to external stimuli (p. 32).

Thus, “emotion is an umbrella term for everything and affect is both conscious and unconscious” (Pankesepp, 2000, p. 32).

However, Davidson (2003) stated that, whereas emotion is conscious, affect is non-conscious. He also suggested that “affect is subcortical and cognition is cortical” (Davidson, 2003, p. 129). He appears to use the words “affect” and “emotion” interchangeably (Davidson, 2003). In addition, efforts have been made to differentiate affect from mood. Taylor clearly distinguished between these states: “Affect is the emotional tone underlying all behaviors … Mood and affect are not synonymous terms. Normal mood refers to relatively transient expressions of sadness, happiness, anxiety, anger and apathy. Mood is but a part of an individual’s affect which is a more global function” (Taylor, 1981, p. 81).

Although emotion and other affective phenomena share some similarities, it is possible to distinguish these phenomena from emotion.

Characteristics of emotion. Various studies have reported that the influence of time and aging on emotion is considerable. One of the key features of emotion is that it is not static but changeable over time. Several previous studies examined the relationship between emotion and circadian rhythms. Existing data showed that positive affect fluctuates systematically throughout the day, with maximum positive affect occurring at midday (Clark & Watson, 1988; Clark, Watson, & Leeka, 1989; Egloff, Tausch, Kohlmann, & Krohne, 1995; Thayer, 1987; Thayer, Takahashi, & Pauli, 1988). Clark and Watson (1988) found that all components of positive affect rose sharply from early morning until noon, remained relatively constant until 9 p.m., and then fell rapidly. Another study also showed that maximum positive affect activation (i.e. maximum activity, attentiveness, inspiration, and interest) was reached in the afternoon and that the pleasantness component of positive affect (i.e., balance, contentment, ease, and happiness) increased from morning to evening (Egloff, et al., 1995). On the other hand, negative affect has shown no systematic diurnal correlation (Clark, et al., 1989; Clements, Hafer, & Vermillion, 1976; Thayer, 1987; Thayer, et al., 1988). One possible reason for consistently positive diurnal variation in affect likely relates to their sample. These studies used college students as subjects all having relatively similar ages and schedules. If non-student groups were to be recruited as study subjects, the pattern of positive emotion might be different. However, these studies did not include sufficient discussion of the reason why negative affects did not exhibit daytime variations.

Another critical characteristic of emotion is aging. A common stereotype suggests that people become less emotional as they age. Empirical studies have also suggested a decline in emotional experience with increasing age (Barrick, Hutchinson, & Deckers, 1989; Diener, Sandvik, & Larsen, 1985; Gross, et al., 1997; Lawton, Kleban, Rajagopal, & Dean, 1992; Wieser, Mühlberger, Kenntner-Mabiala, & Pauli, 2006). Three studies have found age-related decreases in emotional intensity (Barrick, et al., 1989; Diener, et al., 1985; Gross, et al., 1997). One study indicated an age-related decline in the experience of both positive and negative emotions (Diener, et al., 1985); the other studies have also found an age-related decrease in emotional intensity, but only for negative emotions (Barrick, et al., 1989; Gross, et al., 1997). Wiser and colleagues, too, found no relationship between aging and decline and decline of emotion discrimination (Wieser, et al., 2006). Even though some studies have shown evidence of age-related emotional decline, their results were varied.

In the last decade, however, research has shown that older people maintain their emotional well-being (Scheibe & Carstensen, 2010). A growing literature suggests that emotional processing remains stable with aging (Carstensen, et al., 2010; Carstensen & Turk-Charles, 1994; Isaacowitz, Charles, & Carstensen, 2000; May, Rahhal, Berry, & Leighton, 2005; Scheibe & Carstensen, 2010). Using over a decades' worth of experience sampling— a technique that involves random signaling of participants during their daily lives— one study participants (initial sample =184) asked to report their emotional states at five randomly selected times each day for one week. This reporting schedule was repeated five times that year, and then repeated again ten years later. Results indicated that aging is related to more positive overall emotional well-being, with both great emotional stability and more complexity; elderly people thus showed greater co-occurrence of positive and negative emotions than did young adults, after were accounted for personality, verbal fluency, physical health, and demographic variables (Carstensen, et al., 2010). A review of recent emotional aging literatures suggests that emotional aging correlates positively with chronological aging: in contrast, age appears to correlate negatively with cognitive aging (Scheibe & Carstensen, 2010). Thus, more research is needed to establish the long term links between age and emotion.

Emotion of People with Dementia

Research on the emotion has focused mostly on normal subjects, rather than patients with cognitive impairment (Boller, et al., 2002). Some studies of the emotions of people with dementia have even presented conflicting results. However, for caregivers of people with dementia, its most distressing feature is its non-cognitive elements, which can be seen as responses to the patient's emotional state (Bucks & Radford, 2004). In terms of patient care and treatment, the emotional aspects of people with dementia greatly influence both individuals with dementia and their caregivers. This section will discuss the emotional expression, emotional recognition, and psychiatric symptoms of people with dementia.

Emotional expression in dementia. Understanding the nature of emotional expressions via the face, voice tone, and body posture contributes to better behavioral management. In particular, people with dementia exhibit various emotional and behavioral disturbances (Burns, Folstein, Brandt, & Folstein, 1990; Swearer, Drachman, O'Donnell, & Mitchell, 1988). Although little research has been conducted regarding emotional expression in dementia, several studies support the proposition that cognitively impaired people showed less emotional responsiveness and a poverty of emotional expression (Asplund, et al., 1991; Daffner, et al., 1992). Specifically, four patients in the final stage of Alzheimer's disease revealed fragments of facial expressions but no complex expressions (Asplund, et al., 1991). Also, people with AD exhibit diminished curiosity, as measured in a study that examined exploratory eye movements (Daffner, et al., 1992).

However, more recent studies suggest that dementia patients can retain the ability to express basic emotions. Magai and colleagues (1996) examined the quality of emotional expression in mid- to late-stage dementia patients. Their results indicated that patients with AD expressed a range of affective signals including interest, anger, fear, sadness, and joy (Magai, et al., 1996). Specifically, some patients showed various emotional expressions (e.g., sadness, anger, interest, and contempt) even during the last stage of AD; 35% of very-late-stage AD patients expressed sadness. In addition, a case study also indicated that an individual with dementia can experience a range of moods and affective patterns even with significant cognitive impairment (Kolanowski, Litaker, & Catalano, 2002). Later, Kalanowski et al. examined emotional well-being in nursing home residents with dementia at the within-person levels, as rated by informants and by 31 self-reporting residents over a 12-day period (Kolanowski, et al., 2007). Significant within-person variation in positive and negative affect was found as reported by both informants and residents: a range of 40% to 60% of the overall variation in each occurred within persons, across days (Kolanowski, et al., 2007).

Emotion recognition deficit in dementia. Emotion recognition, the ability to perceived emotion expressed by others, is an essential factor in interpersonal relationships. Impaired ability to recognize emotion may negatively affect social functioning and quality of life. Many studies on emotional recognition in dementia have been conducted, but results have been somewhat mixed.

In early studies, PWD displayed on an impaired ability to identify facial expressions. Kurucz and Feldmar (1979) described recognition deficits of facial emotional expressions among people with dementia, which were not related to an impaired ability to recognize faces. In 1983, Brosgole et al. also reported that PWD have an impaired ability to recognize most facial expressions (Brosgole, Kurucz, Plahovinsak, Sprotte, & Haveliwala, 1983). Almost a decade later, Albert et al. (1991) administrated several tests to examine ability to recognize facial emotion, to provide verbal labels of facial emotion, and to either draw or verbalize emotional situations. Authors found that AD patients were significantly more impaired than control subjects for all of the tasks;

however, these impairments disappeared when AD patients' performances were adjusted for their cognitive deficits.

Unlike the authors of previous studies, Roudier and colleagues (1998) found that AD patients could discriminate between facial identity and facial emotions. Subjects were shown eight pairs of the same actor's photos showing facial expressions either of the same emotion or two different emotions as well as eight pairs of different actors' photos showing facial expressions either of the same emotion or two different emotions. For the discrimination of facial identity, subjects were asked the question: "Is it the same or two different people?" For the discrimination of facial emotion, subjects answered the question: "Is the emotion expressed in both photos the same or different?" Their results showed that while AD patients were significantly impaired in discriminating facial identities and in naming and pointing to named emotions, they compared favorably to controls in terms of discriminating facial expressions (Roudier, et al., 1998). A recent study was conducted to determine whether or not AD patients have deficits in recognizing either general or specific facial expressions (Hargrave, et al., 2002). The results showed that patients with AD have deficits in recognizing facial emotions that may be independent of their impaired ability to recognize nonemotional facial features. AD patients also had selective impairment in labeling facial expressions of sadness.

These results could be supported by brain image studies. In functional neuroimaging studies, emotional and non-emotional facial features have been shown to activate different brain areas. The structural aspects of face processing activate ventral occipitotemporal areas (Kanwisher, McDermott, & Chun, 1997), while emotional features activate a network of limbic structures that includes the amygdale, insula, and orbitofrontal cortex (Blair, Morris, Frith, Perrett, & Dolan, 1999; Calder, Lawrence, & Young, 2001; Phillips, et al., 1997; Whalen, 1998). Thus, these results from neuroimaging studies could explain the difference between emotional facial recognition and nonemotional facial recognition among AD patients.

Other studies also showed that PWD retain the ability to recognize emotion. Bucks & Radford (2004) compared an AD group with an age-, gender-, handedness-, and education- matched group in hopes of identifying the meaning of non-verbal communicative signals associated with different emotions. Although the sample size was small (each group consisted of 12 older adults), results showed that the ability to identify non-verbal affect cues in emotional facial expressions and emotional prosody was better preserved than general cognitive ability among those suffering from AD. In addition, no differences between two groups were found to recognize different emotions (happiness, sadness, anger, fear or neutral) (Bucks & Radford, 2004). A recent study of people with severe dementia sought to assess their ability to recognize emotions and to react to facial expressions. It found that the healthy control group recognized more expressions of facial emotion than did the group suffering from dementia, but the differences were not great (Guaita, et al., 2009). In addition, with respect to participants' reactions to face emotion stimuli, there was no significant difference between the control group and the group with dementia in correctly decoding facial expressions.

Following publication of a study which reported perception of emotion to be worse among patients with frontotemporal dementia (FTD) than among those with AD, who did not differ significantly from controls, several studies have focused on people with FTD (Lavenu & Pasquier, 2005). FTD is a neurodegenerative disorder localized primarily in the frontal lobes and the anterior portions of the temporal lobes; it is associated with early behavioral abnormalities, including apathy, emotional blunting, and loss of sympathy and empathy (Lavenu & Pasquier, 2005).

Rosen and colleagues (2002) suggested patients in the temporal variant of FTD (tvFTD) group were impaired in emotional comprehension, which was measured according to how well subjects comprehended facial expressions; they then correlated performance on this measure with atrophy. In addition, the tvFTD group showed more severe impairment of emotions having negative valence—including sadness, anger, and fear— than they did recognizing for happiness (Rosen, et al., 2002). Another study also found that FTD patients have difficulty to recognize negative facial emotions (Fernandez-Duque, Black, Fernandez-Duque, & Black, 2005). Although few studies have been conducted in this area, most of them have shown that people with FTD are less able to recognize emotion than people with AD.

Psychiatric symptoms of people with dementia. Dementia itself is one of the major mental health issues among the elderly; mental health was one of the ten leading health indicators among 28 focus areas measured in Healthy People 2010 (U. S. Department of Health and Human Resources, 2009). The course of dementia is often complicated by other psychiatric symptoms such as depression, anxiety, delusion, and hallucination. These psychiatric symptoms pose serious problems that affect the quality of life, both for people with dementia and their caregivers (Wragg & Jeste, 1989). Among these psychiatric symptoms, this section focuses on depression and anxiety, since they often coexist with dementia.

In particular, three considerations are important to an understanding of the depressive symptoms of dementia. First, because it is difficult to distinguish dementia from depression, sometimes called “pseudodementia,” there is a risk of over-diagnosing depression among people suffering from dementia. The exact frequency of such a misdiagnosis is not known. However, it is possible to distinguish the two conditions through careful evaluation and follow-up (Forsell, Jorm, Fratiglioni, Grut, & Winblad, 1993; Hill, Stoudemire, Morris, Martino-Saltzman, & Markwalter, 1993), since in many cases, patients’ depression is the first symptom of their dementia (Alexopoulos, Meyers, Young, Mattis, & Kakuma, 1993).

Second, although the prevalence of depression varies, individual depressive symptoms appear more frequently than does depression as a mood disorder. While 22% of patients with AD suffer from major depressive episodes, another 27% of them suffer from minor depressive episodes (Lyketsos, et al., 1997). According to Wragg and Jeste (1989), depressive symptoms occurred in 30-40% of AD patients. In terms of depression as a diagnosis, Reifler et al. (1982) reported 20% of PWD having been diagnosed with depression. Another study found that 17% of people suffering from dementia experienced major depression (Rovner, Broadhead, Spencer, Carson, & Folstein, 1989). Thus, most reports estimate the prevalence of depressive symptoms among AD sufferers to lie in the 20% to 50% range; the prevalence of major depressive disorder in this same population appears to be lower, around 10% to 30%.

Third, the prevalence of depressive disorders differs across patient groups. The frequency of depression decreased as the severity of cognitive impairment increased (Reifler, Larson, & Hanley, 1982). Another cross-sectional study of psychiatric symptoms in AD patients showed that major depression was less frequent in patients with severe cognitive deficits than among those with only mild or moderate cognitive deficits (Lopez, et al., 2003). Moreover, depression is more common in AD patients with residing psychiatric or acute medical care wards (42% to 55%) than it is in AD outpatients or research participants (0% to 17%) (Wragg & Jeste, 1989).

Although anxiety is one of the most commonly reported symptoms of dementia, studies of dementia have focused not on patient stress but on caregiver stress (Tueth, 1993). The neuropathology of anxiety in patients with dementia is thus not yet known. From a clinical point of view, anxiety might be related to several kinds of fears that are often experienced by PWD (Bolger, Carpenter, & Strauss, 1994).

The prevalence of anxiety symptoms among people with dementia has been found to vary between 30% and 70%. One study reported that 30% of patients diagnosed as having dementia had one or more anxiety symptoms (Ballard, Boyle, Bowler, & Lindesay, 1996). Teri and Gallagher-Thompson showed anxiety symptoms were common, occurring in 70% of 523 community-dwelling AD patients (Teri & Gallagher-Thompson, 1991). In addition, the results reported based on—whether clinician or caregiver ratings—showed that an anxious or worried appearance was most common in AD patients (68% to 71%), but only 5% to 6% of subjects met DSM-III-R criteria for the diagnosis of generalized anxiety patients with dementia (Ferretti, McCurry, Logsdon, Gibbons, & Teri, 2001).

Anxiety was more common among patients with severe cognitive deficits than among those with only mild or moderate deficits. Teri et al (1991) found that patients with more severe cognitive impairment tended to more anxious than those with mild to moderate cognitive impairment. Feretti et al (2001) also reported anxiety symptoms were associated with increased cognitive impairment.

In this section, emotional expression, emotional recognition, and psychiatric symptoms in dementia were discussed. The general conclusion is that while there is some expected impairment in the ability of people with dementia to perceive emotions, this ability is relatively well preserved compared to other cognitive domains. Additionally, dementia is frequently comorbid with psychiatric symptoms. However, studies for emotional expression were limited; in particular, only one study found significant variation of emotional expression among PWD throughout the days.

Emotion and Wandering

It has been suggested that emotions is a factor that contributes to wandering. Although anecdotal evidence, in the form of clinical observations supports the inference that certain emotion and behaviors in dementia are associated, the relationship between emotion and wandering has not yet been thoroughly explored. However, if emotion is a significant predictor of wandering, this predictor can be used to inform designs for effective intervention. Research showed that nursing strategies that elicited emotion including the use of music, touch, rocking, and massage reduced problematic behaviors in dementia (Ayalon, Gum, Feliciano, & Arean, 2006; Cohen-Mansfield, 2001; Finnema, et al., 2005). Despite the usefulness of emotion as an avenue for intervention, only few studies have addressed the relationship between emotion and wandering.

Lyketsos and colleagues (1997) conducted a study to determine the impact of depression on the AD patient by examining the association between depression and the activity of daily living, behavioral disturbances, and events linked to caregiver burdens. Wandering was assessed as one of the events linked to caregiver burden. They reported that AD patients who had either minor depressive episodes (21%) or major depressive episodes (26%) showed significantly higher rates of wandering than did AD patients without depression (4%) (Lyketsos, et al., 1997).

A descriptive study was conducted to examine the relationship between anxiety symptoms of comorbid depression, the presence of other problematic behaviors, and dementia progression. According to Teri et al. (1999), anxiety symptoms were significantly related to problematic behaviors, including wandering, sexual misconduct, hallucinations, verbal threats, and physical belligerence. The odds ratio was 3.7 for wandering. Noting this result, Lai and Arthur (2003) suggested that PWD who wander seem to be anxious because they feel unsafe in an unfamiliar environment.

Yao and Algase (2006) investigated links between environmental ambiance and wandering among dementia sufferers. Environmental ambiance is an emotional valence of an environment to those living within its boundaries; it uses two subscales (engaging and soothing) to capture an observer's subjective impressions of the nursing home environment. Analysis of results showed that high ambiance scores of the environment were associated with less frequent walking episodes, walks of shorter duration, and longer periods of sitting. The authors suggested that positive environmental valence of an environment may reduce a wanderer's walking (Yao & Algase, 2006).

In summary, there are significant limitations to the extent research regarding emotion and wandering. First, few studies have examined the association between emotion and wandering. Also, the studies that have examined emotion did not make it their primary object of inquiry, but rather treated it as ancillary to other issues. In addition, psychiatric symptoms were mainly measured emotions in people with dementia. Even though emotional expression and recognition are also important components of emotions, they have been ignored in relevant literatures. Other studies, however, have shown the association between emotions and wandering to be significantly strong. Thus, further studies are required to arrive at a better understanding of the connection between wandering and emotion.

Measurements of Emotion in Dementia

While no single "gold standard" method for measuring emotion exists, major advances have been made in recent years to measure its individual components, such as appraisal (Scherer, 2005), physiological response patterns (Stemmler, 2003), and expressive behavior (Harrigan, Rosenthal, & Scherer, 2005). Most research has sought to measure emotion through self-reports, informant reports, or behavior observations. Self-reports are widely used, and comprise one of the easiest techniques for measuring emotions (Larsen & Fredrickson, 1999). The underlying assumption is that research participants are both able and willing to observe and evaluate their own emotions. However, certain populations, such as very young children, very old people, and those with psychiatric problems, may not have the ability to accurately assess their emotional states.

Although they are thus not appropriate for all populations, informant reports have two significant advantages: they are often unobtrusive, and they can capture naturalistic social exchanges (Larsen & Fredrickson, 1999). Any self-report measures recorded are collected from informants. When no special training is required of observers, they can be also inexpensively and quickly evaluated. Contrast to self-reports, behavior observations complied by typically trained observers who code subjects' emotions; the process is part of a comprehensive system that requires extensive training to execute properly (Larsen & Fredrickson, 1999). Therefore, both reliability and validity of behavior observation are usually high. However, direct observation is limited by time constraints (Bolger, et al., 1994).

Measuring emotions of people with dementia presents its own specific issues. Informants may underreport psychiatric symptoms while exaggerating cognitive impairments and caregivers may project their own psychological problems onto a patient. Self-report questionnaires of PWD may not provide accurate estimates of emotional states because PWD may lack the concentration or attention span needed to complete a lengthy self-report measure. However, several studies have shown self-reported assessments by dementia sufferers— both for depression (Snow, et al., 2005) and for quality of life—to be accurate (Trigg, Jones, & Skevington, 2007). In this section, measurements of emotional expression, emotional recognition, and psychiatric symptoms among people with dementia are reviewed.

Studies targeted at emotional expression of PWD compared several measurements each other. In order to examine emotional expression in mid- to late-stage dementia patients, Magai et al. (1996) obtained three measurements: (1) directly observed patient facial expressions; (2) scores from the Adult Behavior Questionnaire (ABQ), which was completed by nurse aides; and (3) scores from the same questionnaire, which was completed by a family member. Direct observations occurred during family visits. During the 20 minute-observation sessions, family members sat to one side of the resident roughly arm's length, while the observers sat on the resident's other side at a distance. The patient's emotional behavior was coded to reflect interest, joy, sadness, anger, contempt, fear, disgust, or a "knit brow" expression. The ABQ is a scale that was designed to measure affect in dementia patients (Magai, et al., 1996). It comes in two versions—the 102 item ABQ-C for caregivers, such as nurse aides, and the ABQ-F for family members, which has 85 items. The two measures differ in that a broader array of ADL areas are tapped in the caregiver version; this is possibly only because aides typically supervise more of a patient's personal care routines than do family members.

Interestingly, while the correlation between family ratings of patient emotion and observer-rated facial expressions of emotion was substantial, the correlation between aide ratings of emotion and observer ratings, and between aide and family ratings, was relatively poor by comparison.

In a relevant study, Kolanowski et al. (2002) gathered descriptive data on mood and affective patterns in an elder with severe cognitive impairments, using two sources of evaluation: resident self-report and direct observation by research staff. The study found a strong positive correlation between self-reported mood and observed affect. The authors concluded that self-reporting is a reliable source of information (Kolanowski, et al., 2002).

In order to measure emotional recognition among people with dementia, a series of photographs displaying facial expressions is used; the emotions depicted include happiness, sadness, disgust, fear, surprise, and anger. Most studies use the Ekman 60 Faces Test (Fernandez-Duque, et al., 2005; Henry, et al., 2008; Roudier, et al., 1998), which is well validated (Young, Perrett, Calder, Sprengelmeyer, & Ekman, 2002) whereas other studies use other type measurements for emotional recognition, such as the Benton Facial Recognition Test (Hargrave, et al., 2002) and the Penn Emotion Recognition Test (Spoletini, et al., 2008). However, the procedure used in all of these emotional recognition assessments is similar. Photographs depicting in facial expressions are displayed to participants who must then determine what emotional expressions are being conveyed.

In order to measure emotion in people with dementia, researchers commonly measure psychiatric symptoms. Weiner et al. (1996) reviewed 16 clinician- and caregiver- rated scales on the basis of their face validity, their psychometric properties, the frequency of their use, and their promise as assessment instruments. Their conclusion was that many instruments are available for the assessment of psychiatric symptoms in dementia, but no single instrument assesses the frequency and severity of all of its psychiatric symptoms. Among 16 scales, The Cornell Scale for Depression in Dementia (CSDD) appears to be the best one for quantifying depression in PWD (Weiner, et al., 1996). The CSDD is an observer-rated scale designed to measure depressive symptoms in dementia. The items were selected from literature reviews of depression in PWD (Greenwald, et al., 1986; Mohs, Rosen, Greenwald, & Davis, 1983; Roth, 1955); this scale has high reliability and validity for diagnostic purposes (Alexopoulos, Abrams, Young, & Shamoian, 1988).

Although many attempts have been made to measure emotion, limitations remain. In particular, emotional expression in dementia is understudied. Emotions involve three components: neural, expressive, and experiential (Kolanowski, et al., 2002). At the expressive level, emotions are displayed through facial activity, posture, and vocal responses. Because there is no study to measure all three responses, further research is necessary to assess emotion at the expressive level by observing facial activity, posture, and vocal responses. This study will measure facial, vocal, and posture emotional expressions.

Summary

Research in emotion has long presented a challenge to researchers in many disciplines. Emotion is even difficult to define because it includes various characteristics such as physiological and temporal aspects, and shares similarities with other affective phenomena such as mood and feeling. Although more attention has been paid to cognition than to emotion, various attempts have been made to understand the role of emotion in dementia. Three aspects of emotion in dementia have been examined: emotional expression; emotional response; and psychiatric symptoms. While consistent results for psychiatric symptoms of people with dementia have been reported, emotional expression and response of individuals with dementia were particularly underestimated. Study results for emotional recognition are inconsistent. Furthermore, research of the relationship between wandering and emotion is insufficient to support discussion, due to the paucity of studies. However, general agreement on preservation of emotional expression has been found. Recently the emotions of people suffering from dementia have received greater attention because of the desire to design a nursing intervention protocol that could help reduce hazardous wandering behaviors. In particular, positive emotional valence to the environment may minimize wandering (Yao & Algase, 2006).

Thus, further studies are necessary to explore emotional expression and response in dementia as well as the relationship between emotion and wandering.

Cognition in Dementia

Cognition impairment is a clinically important symptom, the presence of which aids in the detection of dementia in its early stages. As people with dementia become more cognitively impaired, they lose the ability to care for themselves and become dependent on others for their care (Feldman, et al., 2005). Among the background factors on the NDB model, cognitive abilities interact with emotion to produce wandering behaviors. The third part of this literature review chapter focuses on (1) a comparison of cognitive deficits in people with dementia with those suffering mild cognitive impairment and (2) the correlation between wandering and cognition.

Cognition of People with Dementia

Cognitive impairment is a hallmark of dementia because of the progressive neurodegenerative nature of the disease. However, not all cognitively impaired people have dementia. First of all, these terms—dementia and mild cognitive impairment (MCI) — refer to clearly distinguishable conditions, as an examination of their definitions will reveal.

Dementia interferes with a person's daily function due to a cognitive decline (Kelley, Petersen, Kelley, & Petersen, 2007). According to the American Association for Geriatric Psychiatry (2006), "dementia is a clinical syndrome characterized by global cognitive decline with memory and one other area of cognition affected that interfere significantly with the person's ability to perform the tasks of daily life and meet the Diagnostic and Statistical Manual of Mental Disorders, fourth edition text revision (DSM-IV-TR) criteria" (p. 562). In addition, there are subcategories of dementia which include Alzheimer's disease (AD), dementia with Lewy bodies, dementia with Parkinson's disease, dementia with Huntington's disease, frontal-temporal lobe dementia, and Pick's disease. Among these types of dementia, AD is the most common form of dementia among elderly persons, accounting for approximately two- thirds of cases of dementia. According to the DSM-IV-TR criteria, AD diagnosis requires the presence of memory impairment and cognitive deterioration in one other domain, such as language, perception, motor skills, or disturbances in executive functioning (American Psychiatric Association, 2000). The National Institute of Neurological and Communicative Diseases and Stroke/Alzheimer's Disease and Related Disorders Association (NINCDS/ADRDA) criteria classify AD according to one of three categories: definite (clinical diagnosis coupled with a histological confirmation of Alzheimer's disease); probable (clinical diagnosis without a histological confirmation); and possible (atypical symptoms with no apparent alternative diagnosis in the absence of a histological confirmation).

Along with dementia and AD, MCI has received increased attention as a transition state between normal aging and dementia. Although controversy exists in terms of best assessment of MCI (Petersen et al., 2001; Winblad et al., 2004), Petersen (2004) proposed criteria for MCI as a diagnostic entity: (1) cognitive complaint by an informant in particular; (2) objective cognitive impairment by clinicians, compared to their age- and education-mates; (3) relatively normal general cognition except in one primarily impaired cognitive domain; (4) preserved activities of daily living; and (5) not demented (Petersen, 2004). A number of studies used Peterson's criteria to define MCI (Arsenault-Lapierre, Chertkow, & Lupien, 2010; Geslani, Tierney, Herrmann, & Szalai, 2005; Kelley, et al., 2007)

As seen, cognitive decline is a key element used to characterize dementia as well as MCI. Understanding those phenomena thoroughly requires an evaluation of both the specific domains of cognition (e.g., memory and executive function) of people with dementia and MCI, and the nature and level of global cognitive impairment in dementia and MCI. Abundant empirical research has been conducted to examine cognitive function in people with dementia and MCI.

Memory change in dementia. Since memory loss is a core feature for diagnosing AD as well as MCI, numerous studies have been conducted to identify the relationship between memory change and dementia. A longitudinal study suggested that verbal memory decline is the earliest sign of a preclinical stage of AD (Howieson, et al., 1997). Individuals who subsequently developed dementia showed evidence of verbal memory impairment at their initial examination, which was a mean of 2.8 years before clinical evidence of dementia manifested itself. Another study found that onset of dementia in cognitively healthy elderly people was related to a sharp decline in global psychometric performance (Rubin, et al., 1998). Moreover, many researchers claimed that episodic memory impairment in particular is an important feature of impending dementia (Backman, Small, & Fratiglioni, 2001; Elias, et al., 2000; Grober & Kawas, 1997; Linn, et al., 1995).

Furthermore, several longitudinal studies have tried to differentiate memory function among individuals with MCI, those with AD, and healthy people (Bowen, et al., 1997; Petersen, et al., 1999). In order to understand the progression of subjects with MCI to AD, researchers compared subjects with MCI to patients with mild AD, and to healthy control subjects. Subjects with MCI showed more memory problems than control subjects (healthy group); however, other cognitive functions were comparable between two groups (Petersen, et al., 1999). However, when the subjects with MCI were compared to those with very mild AD, memory performance of both groups was found to be similar, but subjects with AD were more impaired in other cognitive domains. In terms of annualized rate of cognitive decline, the subjects with MCI declined more rapidly than did of the controls, but less so than patients with mild AD. Bowen and colleagues (1997) conducted a longitudinal study to investigate the natural history of isolated memory loss, which is identified by severe memory loss but displaying no other type of cognitive impairment. Despite the small number of subjects, this study suggests that severe isolated memory loss could be an incident symptom of AD.

In addition, a recent cross-sectional study reported similar results on cognitive complaint in MCI and AD (Clement, et al., 2008). The findings indicated that participants with MCI reported more memory impairment than controls for a range of specific materials whereas MCI and AD participants did not show memory impairment differences.

In accordance with empirical studies, memory change in AD has been explained by a correlating change in the medial temporal lobe memory system (Buckner, 2004). The memory temporal cortex, including the hippocampus and adjacent cortical areas, is critical for long-term, declarative memory (Squire, 1992). Atrophy, cellular pathology, and cell loss are observed prominently in medial temporal structures in the etiology of

AD; all lead to memory impairment (Buckner, 2004). At the cellular level, AD is associated with a build-up of amyloid and tau in pathological form (Mattson, 2004). Amyloid plaques and soluble forms of amyloid lead to neuronal dysfunction and cell death. Pathologically, concentrations of neurofibrillary tangles in the medial temporal region of the brain have been linked to memory impairments (Guillozet, et al., 2003).

Other cognitive changes (e.g. executive function, attention) in dementia. Along with memory change, other cognitive functions of individuals with dementia have been examined. A meta-analysis based on 47 studies from 1983 to 2003 involving 9,097 controls and 1,207 preclinical AD cases was conducted to determine the size of the impairment across different cognitive domains in preclinical AD (Backman, et al., 2005). To assess cognitive domains, these researchers measured global cognitive ability, episodic memory, executive memory, executive functioning, verbal ability, visuospatial skill, attention, perceptual speed, and primary memory. The results showed preclinical impairments of all cognitive domains including global cognitive ability, executive function, and verbal ability, but no preclinical deficit in primary memory (Backman, et al., 2005).

Moreover, relevant longitudinal studies of cognitive area deficits other than memory loss present useful conclusions. Older people without symptoms of dementia often show difficulties with tasks that stress attention and executive abilities (Balota, Dolan, & Duchek, 2000; Moscovitch & Winocur, 1995; West, 1996). By contrast, early stages of AD are hallmarked by deficits in declarative memory, such as difficulty in remembering short lists of words or objects (Hupperet, 1994), although its effects on executive function can also be detected (Balota & Fayst, 2001). Guarch and colleagues

(2004) found that the impairment of cognitive areas is significant in subjects with memory complaints. In particular, impairment in concept formation, vocabulary and recognition of similarities, learning, and several executive functions were reported (Guarch et al., 2004).

Indicators of other domains of functioning may be aid in identifying specific risks of AD which act as precipitating factors; those precipitating factors, in turn, provide further help in differentiating between preclinical AD and non-progressive cognitive impairment. These factors include volume reduction of the anterior cingulated and temporal sulcus (Killiany, et al., 2000), posterior cingulated and neocortical temporoparietal regions (Fox, et al., 2001), and frontal regions (van der Flier, et al., 2002); decreased blood flow in posterior cingulate and precuneous parietal regions (Arnaiz, et al., 2001); and deposits of amyloid plaques in the frontal cortex (Yamaguchi, Sugihara, Ogawa, Oshima, & Ihara, 2001).

Correlates of cognitive decline. Although progressive cognitive decline is the main clinical manifestation of people with dementia, relating factors of cognitive decline in people with dementia remain controversial. However, some risk factors have been consistently suggested in a number of studies.

High education attainment is associated with an accelerated rate of cognitive decline in AD patients once they are diagnosed (Scarmeas, Albert, Manly, & Stern, 2006; Wilson, et al., 2004). Once dementia is clinically manifest, AD is likely to be more pathologically advanced in those with more education than in those with less, which fact typically results in more rapid decline of cognition (Scarmeas, Albert, Manly, & Stern, 2006).

On the other hand, epidemiological studies have shown that lower educational attainment is associated with increased risk for incident dementia (Qiu, Backman, Winblad, Aguero-Torres, & Fratiglioni, 2001; Stern, et al., 1994; Tervo, et al., 2004; White, et al., 1994). Those observations also explained that people with higher cognitive reserve can cope with development of AD pathology longer than people with lower one before AD is first clinically manifested (Scarmeas, et al., 2006).

In addition, age is also significantly associated with increased risk of cognitive decline. Advancing age has been recognized as one of the highest risk factors of AD (Fratiglioni, 1996; Lindsay, et al., 2002). Increasing age affects transitions from a cognitively normal state into MCI or into dementia (Kryscio, Schmitt, Salazar, Mendiondo, & Markesbery, 2006). In summary, the results suggest that level of education and age may play important roles in cognitive impairment.

Cognition and Wandering

Among all contributing factors to wandering behaviors, cognitive ones have received the most attention in studies of wanderers. In most instances, cognition was regarded globally, but studies focused on specific domains of cognitive function have also been reported. This section reviews the relationship between cognition and wandering.

Studies of wandering and global cognitive function. Many studies have suggested a clear link between wandering and degree of cognitive impairment. According to an annual review of nursing research by Algase, wanderers had more cognitive impairment and poorer performance in all cognitive dimensions (abstract thinking, language, judgment, and spatial skills) than non-wanderers (Algase, 1999a). Whether evaluated through the use of global impairment measures (Algase, Beattie, & Therrien, 2001; Buchner & Larson, 1987; Burns, Folstein, et al., 1990), or through calculation of the proportion of wanderers at various levels of cognitive impairment (Ballard, Mohan, Bannister, Handy, & Patel, 1991; Cooper & Mungas, 1993; Klein, et al., 1999; Teri, et al., 1988), wanderers have consistently shown poorer cognitive function than non-wanderers have.

In addition, researchers reported that wandering is associated with accelerated decline in overall cognitive functions (Algase, Beattie, & Therrien, 2001; Holtzer, et al., 2003; Miller, Tinklenberg, Brooks, Fenn, & Yesavage, 1993; Schonfeld, et al., 2007; Teri, et al., 1988), and faster functional decline and institutionalization (Scarmeas, et al., 2007).

Specific neurocognitive factors and wandering. Other studies, however, have shown that more specific neurocognitive factors (e.g., spatial disorientation, attention, memory, and circadian rhythms) are more closely related to wandering, than is global cognition. Researchers have examined the relationship between spatial orientation and wandering. A study that examined wandering behavior in patients with parietal lobe lesions revealed specific defects in their spatial orientation ability (de Leon, Potegal, & Gurland, 1984). Among 21 patients with AD, a subgroup (n=5) often became lost, and wandered even in familiar surroundings. This group differed from the rest of the patients with AD in terms of their performance on tests of parietal function, but not on a generalized test of mental status. Leon et al. concluded that wandering in AD patients may indicate some parietal lobe involvement (de Leon, et al., 1984).

In addition, a study evaluating the relationship between wayfinding and wandering revealed that wayfinding effectiveness were negatively correlated with the spatial disorientation dimension of wandering (Algase, et al., 2004). Another study, exploring the relationship between being lost and executive functions, targeted 116 outpatient patients with dementia in Taiwan (Chiu, et al., 2005). Wayfinding is closely related to executive functions such as determination of destination or a path (Lezak, 1982; Chiu, et al., 2005). The results of the stepwise multiple regression indicated that executive functions could significantly predicted wayfinding strategies, while controlling for the participants' age, gender, educational level, and depressive symptoms (β=0.23, $p<0.05$).

Along with spatial disorientation, both attention deficits and perseveration (an inability to disengage attention) have been used to explain wandering (Algase, 1999a). Ryan et al. (1995) found differences for perseveration between wanderers and non-wanderers. However, spatial orientation was similar between two groups. Since Ryan's samples were AD patients within the mild to moderate stage, graphomotor perseverations may be more salient to wandering than spatial orientation among AD patients during the disease's mild to moderate stages. Recently, Chiu and colleagues demonstrated that impairment in directed attention in early AD stages predicted which resulted in getting lost behavior (Chiu, et al., 2004).

In terms of the relationship between memory and wandering, at least two studies have been published. Wanderers had more problems than non-wanderers with recent and remote memory (Synder, et al., 1978). Based on the Minimum Data Set (MDS) data gathered from 8,982 nursing home residents from several states, a cohort study employing multivariate analysis showed that residents with a short term memory problem (OR=3.05) and a long-term memory problem (OR=2.06) were more likely to develop wandering behavior than were residents without these problems (Kiely, et al., 2000).

Lastly, several studies reported the association between circadian rhythm and wandering. A comparison study between subjects with AD and healthy control subjects was made to examine the circadian rhythms of core-body temperature and walking activity (Satlin, Volicer, Stopa, & Harper, 1995). AD subjects had more nocturnal activity and a lower amplitude circadian rhythm for motor activity than did the control; but no difference in amplitude of core-body temperature was found between two groups (Satlin, et al., 1995). However, another study has reported that AD subjects had a large mean difference in acrophases of activity and temperature cycles, due to shrinking of the suprachiasmatic nucleus, which medicates activity and temperature rhythms (Swaab, Fliers, & Partiman, 1985).

Global cognition and walking. A review paper supported the proposition that walking is a cognitive process requiring higher-level control movement (Sheridan & Hausdorff, 2007). Walking requires attention and use of the executive function, particularly if it involves a sudden change in incoming sensory information, such as to the composition, direction, or angle of a walking surface, or a sudden decrease in visual or aural acuity (Sheridan & Hausdorff, 2007). Thus, changes in cognitive function in AD, contribute to gait disturbances and increase the risk of falling among AD patients. Duff, Mold & Roberts (2008) also suggested that walking affects cognition, either directly or indirectly, and vice versa. The purpose of this study was to assess the relationship between walking speed and global cognition among 675 community dwelling older adults. The results showed that after adjusting for age, gender, and education, there was a negative relationship between walking speed and global cognition. Duff and colleagues (2008) concluded that in these older adults, global cognition was related to walking speed.

Summary

In summary, clear links between cognition and wandering were stated. However, there are several limitations in studies of cognition and wandering. Since most studies are limited to AD samples, further studies are needed to examine specific functions in other dementias and to equate disturbances with the dimensions of wandering. In addition, these studies mainly rely on a dichotomous classification of wanderers and non-wanderers and fail to directly measure the wandering, itself. Thus, further studies using specialized assessment tools are required to examine more explicit associations between wandering and cognition (Schonfeld, et al., 2007).

Emotion and Cognition in Dementia

For a long period of time, the relationship between emotion and cognition has been ignored due to a dominant western view that emotion is a dangerous, invasive force that contaminates rational thinking (Forgas, 2008). Most recent empirical studies, however, have begun to show that emotion and cognition are integrated in the brain (Pessoa, 2008). This section briefly summarizes what is known about how the relationship between emotion and cognition in dementia is postulated to operate.

Emotion, Cognition, and Behavior in Dementia

To date, there have been no studies have yet focused on the relationship between cognition and emotion among dementia patients with the exception of a study by Yao and Algase. One of the important findings resulting from this study was that ambiance (i.e., emotional valence of an environment) was a more robust predictor of wandering than is cognitive impairment. Using Yao's locomoting responses to environment in elders with dementia (LRE-EWD) model, this study found that emotional responses of the environment are more rapid than cognitive ones (Yao & Algase, 2006). It may be that wandering may be not the sole emotional response to coping with severely cognitively impaired people, but rather an emotional response to social or physical environments (Yao & Algase, 2006).

With regard to brain changes, atrophy and other neuropathological changes in the amygdala characterize early AD (Leherichs, Baulec, & Chiras, 1994). The memory impairment that accompanies AD may reflect amygdala dysfunction, but emotional reactions have been shown to be normal in AD patients (Leherichs, Baulec, & Chiras, 1994). It is likely unknown how those changes in people with dementia affect their behavior, particularly wandering behaviors. Therefore, further study is necessary to determine the extent to which behavior is influenced by the interaction of cognition and emotion.

In summary, although cognition and emotion can be analyzed independently, research has showed a close interdependence between the two. Also, their interactions have been shown to shape behavior. In order to understand behavior, it is necessary to examine not only cognition-behavior relation and emotion-behavior relation separately, but also to evaluate the effects on behavior of interactions between cognition and emotion.

Conceptual Framework

A conceptual framework provides the overall direction for practice and research (Fitzpatrick & Kazer, 2005). Although many previous studies on wandering have not employed theories or models, several researchers have recently begun using conceptual or theoretical frameworks in their attempts to explain wandering behaviors. The theoretical model proposed for this study was based on theoretical frameworks for wandering behaviors. The fundamental bases of the proposed model were: the Need-driven Dementia-compromised Behavior (NDB) model (Algase, et al., 1996) and the Locomoting Responses to Environment in Elders with Dementia (LRE-EWD) model (Yao & Algase, 2006).

Need-Driven Dementia-Compromised Behavior (NDB) Model

A group of researchers proposed a behavioral model for persons with dementia from a nursing viewpoint; this model used a synthesis approach to integrate scholarly findings that either isolated contributing factors or supported underlying mechanisms for these behaviors (Algase, et al., 1996). One of the most important contributions of this model is that it has changed current thinking about behavioral symptoms of dementia, such as wandering, agitation, and restlessness; this change is due to the NDB model's treatment of dementia-related behaviors as meaningful indicators of unmet need, rather than merely behaviors that are bothersome to caregivers (Kovach, et al., 2005).

The NDB model suggests two types of interaction factors that result in need-driven behaviors: background and proximal. Background factors include cognitive status, general health, personal characteristics and sociodemographic factors. These factors are individual characteristics that are relatively stable in the short-term. Proximal factors consist of personal need states, both physiological and psychological; and environmental conditions, both physical and social. These factors encompass current situational factors, such as underlying need states and patient inability to express their needs in a normal manner (Kovach, et al., 2005). Both background factors and proximal factors interact to produce need-driven behaviors.

This comprehensive model provides a specific view of wandering behaviors; empirical studies reported the relationship between several background factors (e.g., personality and cognition) and wandering, as well as the relationship between several proximal factors (e.g., physical environment and emotional ambiance) and wandering . The literature review related to these relationships is presented earlier in this chapter. For example, while wandering is associated with physical environment (e.g., a complex physical design), aggression or problematic vocalization may not be affected by such a complex environment. Wandering is not usually related to caregiving activities, as aggression and problematic vocalization are known to be (Algase, et al., 2007). The NDB model describes wandering as a complex behavior reflecting interaction among multiple individual mechanisms.

Locomoting Responses to Environment in Elders with Dementia (LRE-EWD) Model

A model of locomoting responses to environment in elders with dementia (LRE-EWD) was developed to understand how environment alters wandering and other NDBs (Yao & Algase, 2008). Using a theory synthesis approach, this model shows person-environment interaction in dementia (Algase, et al., 2007). As depicted in Figure 2.1, the LRE-EWD model illustrated the affective pathway as the primary conduit governing immediate dementia-environment interactions and emotional-cognitive interplays. Based on a review of psychology and neuroscience literatures, Yao's study addressed the following five assumptions in supporting this model (Yao, 2004, p. 70).

1. Behavior is the outcome of cognitive and emotional processing of environmental information.
2. Bodily responses have a primary relationship with emotion not cognition (LeDoux, 1996).
3. Motor response is both a type of emotional response (Aldolphs, 1999) and a fundamental issue associated with all basic emotions (Davidson, 2003; Ekman, 1992; Pankesepp, 1998).
4. Emotional responses are mostly adaptive.
5. Although the primary reaction to the environment, emotion yields rigid and automatic responses; cognition yields flexible and optimal ones.

Therefore, the LRE-EWD model postulates that people engage with their environments through cognition and affective reaction (Yao & Algase, 2006). This model also shows that emotional responses to the environment occur more rapidly than cognitive ones (Yao & Algase, 2006).

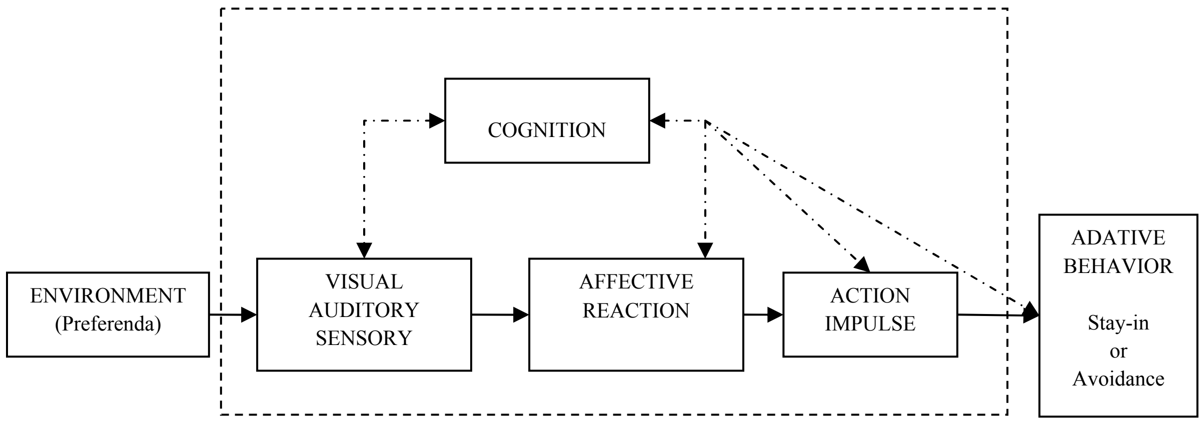


Figure 2.1. LRE-EWD Model
Note. Adapted from *Locomoting responses to environment in elders with dementia: A model construction and preliminary testing* (p. 71), by L. Yao, 2004, Dissertation, University of Michigan, Ann Arbor, MI.

Proposed Theoretical Model

A theoretical model is proposed for this study as seen in Figure 2.2. This theoretical model is constructed using theory derivation. According to Walk and Avant (2005), theory derivation has specific three steps: (1) recognizing the level of theory development in your own field; (2) reading widely in nursing and in other fields for ideas; (3) selecting a parent theory to use for derivation; (4) identifying what content and/or structure from the parent theory to use; and (5) developing or redefining any new concepts or statements from the content or structure of the parent theory. Based on an extensive literature review, the NDB model and the LRE-EWD model were selected as parent theory. This study was designed to examine the relationship of emotion-cognition to wandering. Cognition is considered to be a mediating response to emotional states.

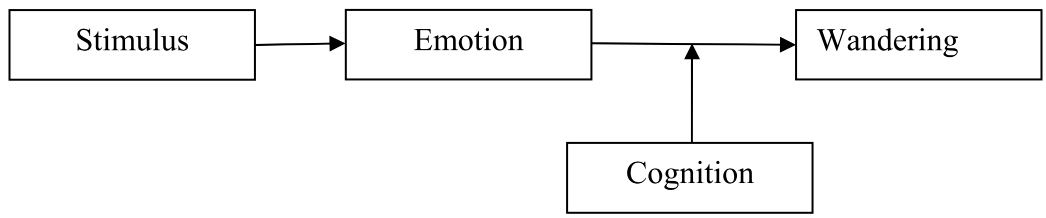


Figure 2.2.Proposed Theoretical Model

Theoretical and operational definitions of concepts that are used in this theoretical model are as follows.

Wandering: Wandering behavior was defined by Algase et al. as “a syndrome of dementia-related locomotion behavior having a frequent, repetitive, temporally-disordered and/or spatially-disoriented nature that is manifested in lapping, random and/or pacing patterns, some of which are associated with eloping, eloping attempts or getting lost unless accompanied” (Algase, et al., 2007). Among four patterns of locomotion—direct, random, pacing, and lapping— random, pacing and lapping patterns were considered variants of wandering. Frequencies and durations of each pattern were measured.

Cognition: Cognition is defined as “consisting of several functional domains, including memory, attention, concept formation and reasoning, motor speed, mental status, and perception” (American College of Obstetricians and Gynecologists, 2004, p. 25S).

Emotion: Emotion is theoretically defined as a complex set of interactions among subjective and objective factors, mediated by neural/hormonal systems, which can (a) give rise to affective experiences such as feelings of arousal or pleasure/displeasure; (b) generate cognitive processes such as emotionally relevant perceptual effects, appraisals, labeling processes; (c) activate widespread physiological adjustments to the arousing conditions; and (d) lead to behavior that is often, but not always, expressive, goal-directed, and adaptive (Kleininginna & Kleinginna, 1981, p. 355).

Within the focus of emotion in dementia, empirical studies have examined emotional expression, emotional recognition, and psychiatric symptoms of affected people. Along with these three emotion-related foci, emotional expression is used to measure emotion in PWD. Emotional expression includes facial displays, vocalizations, and body movements/posture, which comprise a list of behaviors commonly associated with positive and negative emotional expression.

CHAPTER III

METHODS

This chapter describes the research methods employed to answer the three aims of this study: (1) to explore emotional expression in PWD over the daytime period; (2) to examine the relationship between patterns of emotion and wandering in PWD; and (3) to examine the relationship between frequencies of emotion and wandering in PWD. Research design, site and sample, data collection procedure, data analyses, and human subject criteria are included.

Research Design

This study was a secondary analysis of a subset participants of a NIH/NINR funded project entitled "Wandering: Background and Proximal Factors" (NR04569). The purpose of the parent project was to evaluate background and proximal factors, which possibly affect the generation and manifestation of wandering behaviors; data were collected in long-term care settings. In the parent study, a cross-sectional design was used with repeated measures nested within subjects. Research subjects recruited were randomly assigned to six 20-minute observation periods, on each of two non-consecutive days, according to four pre-established randomization schedules. All observation periods were randomly selected and occurred between 8 am and 8 pm. Together, the four schedules covered the entire diurnal period (i.e., every minute of the day from 8 am to 8 pm). Since each study aim required a different analysis, each analysis method is explained specifically in the data analysis section.

Site and Sample

Subjects of the parent project entitled “Wandering: Background and Proximal Factors” were cognitively impaired older adults residing in two type of facilities: some lived in from 17 nursing homes (NHs) having more than 100 beds altogether, while others lived in six assisted living facilities (ALFs); all NHs and ALFs were situated within a six-county metropolitan area in Michigan and Pennsylvania. Sampling consisted of a random cluster sampling approach, encompassing long term care facilities (serving as clusters) within a 60 mile radius of the research institution. The following were inclusion criteria in the parent project:

1. Were 65 years of age or older
2. Met the DSV-IV criteria for medical diagnosis of dementia
3. Had a Mini-Mental Status Exam (MMSE) score less than 24 out of 30
4. Was ambulatory (not wheelchair-bound)
5. Was restraint free
6. Had family or other close informant willing to be interviewed
7. Had been engaged in a stable medication regime during the 30 days prior to observation, and remained so throughout the study
8. Spoke English (not necessarily as a first or primary language)
9. Had continuously resided in the unit for at least three months
10. Were free of tremors in the non-dominant hand
11. Had vision adequate to support normal communication
12. Could hear well enough to support normal conversation

13. Were free of acute illness and psychiatric illnesses, other than AD and multi-infarct dementia

Family or legal proxies for all potentially eligible subjects at each chosen site were contacted by nursing home staff to determine whether the former were interested in having residents participate in the study. Only proxies who expressed initial interest were contacted; those who continued to express interest were asked to execute proxy consent orders. After consent orders were obtained, residents were screened for eligibility. Only those from whom consent was obtained by proxy, and who also met eligibility requirements, were included.

The sample in the parent study consisted of 185 participants. A total of 142 from the parent project who had both wandering and emotion observations were included in this study's analyses.

Measures

This section describes key variables of emotion, wandering, cognition, resident characteristics, and time of day.

Wandering. For the first and third aim, the observation-level variable "wandering rate" was used to measure wandering; for the second aim, the person-level variable "wanderer" was used to measure wandering. Wandering behaviors were video-taped in the NHs or ALFs and were later coded through a computer program (Noldus Observer® 5.0 software). The start of each ambulation episode defined as commencing upon a resident's taking three steps forward was indentified and timed until it ended defined as occurring when a resident changed position, to sitting or laying or stood making no forward movement after 15 seconds. All episodes were coded for pattern at the conclusion of an ambulation episode using Martino-Saltzman et al.'s (1991) typology. Consistent with a parent study, lapping, pacing and random patterns were deemed to constitute wandering; the direct pattern was defined as non-wandering walking. Wandering was measured by a rate parameter. Wandering rate was defined as the frequency of episodes within an observation period. Thus, wandering rate is wandering episodes per hour.

The wanderer variable was employed from the pre-existing wandering typology variable (classic, moderate, subclinical, and not-clustered) (Algase et al., 2009). Based on rate and duration of participants' wandering, three groups of wanderers were identified through cluster analysis as either classic, moderate, or subclinical. These three clustered groups (i.e., classic, moderate, and subclinical) were aggregated as indicating "wanderer"; not-clustered individuals were labeled that of a "non-wanderer" .

Of these three groups, "classic wanderers" exhibited the highest wandering rate and duration, the most severe cognitive impairment, and the greatest mobility. One of the unique findings of this study is that this group showed more severe heart problems than other wanderers (Algase et al., 2009). "Moderate wanderers" had both lower wandering rates and duration than did classic wanderers, and although they had better cognitive function than classic wanderers, they had poorer mobility. They were also the healthiest of the three groups (Algase et al., 2009). Finally, "sub-clinical wanderers" showed the lowest wandering rates and duration among these three groups. They had the highest cognitive function among wanderers, and mobility functions similar to those of moderate wanderers. They were healthier than classic wanderers, but not as healthy as moderate wanderers (Algase et al., 2009).

Emotion. The Observable Displays of Affect Scale (ODAS) was used to capture emotion of PWD (see Appendix A). The ODAS was designed to rate videotaped data; it contains measures of 41 behaviors, and comprises six subscales (facial displays, vocalizations, and body movement/posture by positive and negative quality) (Vogelpohl & Beck, 1997). Raters observe the presence/absence of each behavior in ten two-minute increments from a 20 minute videotape using the Noldus Observer® 5.0 software. Reliabilities for the ODAS have been published: inter-rater reliability was ranged from .68 to 1.00 and intrarater reliability ranged between .97 and 1.00 (Vogelpohl & Beck, 1997).

Cognition. The Mini-Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975) not only has been used to measure cognition of PWD in a large number of studies but also is the most widely used in many languages (Bird, Canino, Stipec, & Shrout, 1987; Katzman et al., 1988; Park & Ha, 1988).

The MMSE, which consists of questions addressing a range of cognitive domains, has a maximum score of 30 points and ordinarily can be administered in 5-10 minutes. The questions typically have been grouped into seven categories, each representing a different cognitive domain or function: Orientation to Time (5 points); Orientation to Place (5 points); Registration of Three Words (3 points); Attention and Calculation (5 points); Recall of Three Words (3 points); Language (8 points); and Visual Construction (1 point). Originally, however, both the orientation categories and the visual construction task were classified as a language item. A score of 23 or less generally has been accepted as indicating the presence of cognitive impairment. In this study, participants who were too impaired to complete testing were assigned a score of -1, as had been done in the parent study.

Resident Characteristics. Resident characteristics included age, gender, ethnicity, education, and mobility. Education was categorized as 1) less than 7 years; 2) junior high school; 3) high school; and 4) college or higher. Since only one resident had less than 7 years of education, data for two categories— less than 7 years of school and junior high school— were aggregated. Data obtained from review of medical records in the parent study were used.

Time of day. Time of day records the military time when an observation was made.

Table 3.1. Summary of Measurement of Study Variables

Variable	Instrument
Emotion	
Positive emotion	Sum score of positive emotion (range: 0-95 ; higher score= higher positive emotion)
Negative emotion	Sum score of negative emotion (range: 0-110; higher score= higher negative emotion)
Wandering	
Wandering rate	Number of wandering episodes during the observation period (wandering episodes/ hr)
Wanderer	Wanderer or Non-wanderer
Variable	Instrument
Cognition	Total score on MMSE (range: -1-24; higher score= less impaired cognition; -1: untestable)
Resident characteristics	
Age	Mean age
Gender	Male or Female
Race	Caucasian or Other
Education	College and higher, High school, Junior high school or less
Mobility	Independent or Assisted
Time of day	Local military time when observation was made

A summary of the measurement of key variables is presented in Table 3.1.

Procedure and Data Preparation

This is a summary of procedure employed in conducting the parent study and preparing data. Once a site had been randomly selected, permission for conducting the study was obtained from the site's administrator. Then, after a site contact person had been designated, a list of all eligible residents was made. The site contact person subsequently initiated and facilitated contact between the project staff and the resident's proxy to discuss each resident's participation in the study. Research staff contacted only those proxies who had agreed to be contacted. Since all subjects of this study are cognitively impaired, legal proxies authorized to make medical decisions for them were contacted to secure each resident's consent. Verbal consent via telephone was sought prior to written consent so that residents could be screened and their eligibility confirmed. Once a proxy consented, information regarding each resident (e.g., name) was given to research staff for formal screening. Formal screening consisted of administration of the MMSE to all assenting residents; this was done by a PhD prepared nurse researcher. Resident characteristics were obtained from chart review and/or assessed by one of three project staff who are gerontological nurse practitioners (NPs). If all inclusion criteria were met, behavior observations were scheduled. Wandering and emotional expression were observed and video-taped by a group of research assistants (RAs), most of whom are nursing undergraduate students.

Subjects were randomly assigned to six 20 minute observation periods, on two non-consecutive days, according to four pre-established randomization schedules.

Observation periods were randomly selected and occurred between 8 am and 8 pm. Together, the four schedules covered all periods from 8 am to 8 pm. Subjects were videotaped, one per camcorder, for a total of four scheduled hours each, to obtain data regarding their wandering and other need states. During observation times, subjects were continuously monitored by a RA-operated a Sony DSR-PD100SA digital camcorder located from 10 to 20 feet away. All RAs were trained for 8-12 hours before data collection began, to learn procedure and to master video-taping technique.

For data preparation, video tapes of residents' behavior were coded using Noldus Observer® 5.0 software. Coders of these video files were different from those RAs who did the videotaping. Before coding began, coders were required to successfully complete 16 hours of practice; were scores of test assessing coder competence compared to the Gold Standard, established by the project directors, who were PhD prepared and had participated in several prior studies utilizing the identical coding schema. Coder agreement was reassessed throughout the study by obtaining independent dual ratings of 10% of the observation periods recorded. Coders were permitted to code only one three-hour data tape per session, to reduce coder fatigue. The Noldus Observer has several statistics functions permitting users to calculate coding reliability; to compute basic statistics, such as total numbers, durations, frequencies, and standard deviations, and so on. In this study, wandering rates and emotion scores were calculated using the Noldus Observer software, and then exported to the Statistical Package for the Social Science (SPSS) program for further computation and analysis. After a statistician removed potential identifiers of residents, the data set for this study was ready to be analyzed.

Data Analysis

Data were analyzed using the Statistical Package for SPSS 17.0, SAS 9.0, and Hierarchical Linear Modeling (HLM) 6.0. Dependent variables and independent variables used in this study are listed in Table 3.2.

Table 3.2. Study Variables by Aim

Variable	Aim 1	Aim 2	Aim 3
Emotion			
Positive emotion sum score	D, DV		IV
Negative emotion sum score	D, DV		IV
Pattern of emotion	D	IV	
Negative of emotion	D	IV	
Wandering			
Wandering rate			DV
Wanderer		DV	
Cognition	IV		CV
Resident characteristics			
Age	IV		CV
Gender	IV		CV
Race	IV		CV
Education	IV		CV
Mobility	IV		CV
Time of day	IV		CV

D: descriptive summary, IV: independent variable, DV: dependent variable,
CV: covariate

Descriptive statistics were generated for each variable before the main statistical analyses were conducted. Analysis methods employed to answer each of the research aims and questions follow, since each study aim of this study required the use of a different analytical method.

Aim 1. Question 1.1. How do positive and negative emotional expression relate to each other?

Pearson correlation analysis was employed to address the relationship between positive emotional expressions and negative emotional expressions.

Aim 1. Question 1.2. Does observable emotional expression vary by resident characteristics, cognition, and time of day?

Two-level hierarchical linear modeling (HLM) (Bryk, Raudenbush, & Congdon, 1996), a multilevel process, was employed in addressing question 1.1. Repeated observations of emotional expression represent level-1 data units that are nested for each resident (level-2). For such data, HLM is an option because it estimates the errors for each participant separately (Bryk, Raudenbush, & Congdon, 1996). It uses a combination of fixed effects chosen for inclusion in the model (e.g., cognition, age, etc.), and random effects that show variability among participants irrespective of group membership (e.g., observable emotional expression). Therefore, HLM permits consideration of separate error terms for each participant. The HLM 6.0 software package (Scientific Software International, Inc.) was utilized for HLM modeling.

HLM creates estimates for level-2 parameters (parameters that are constant for a resident, e.g., cognition and resident characteristics), which are then used to make estimates of level-1 parameters (parameters that vary by observations, e.g., positive and negative observable emotional expression and time of day). By using a two-level model, we can see whether different residents show systematic differences in the strength of the relationship between independent variables (i.e., cognition, resident characteristics, and time of day) and dependent variables (i.e., positive and negative observable emotional expression). Instead of traditional linear regressions, Poisson regressions with over-dispersion command were used to test aim 1. Question 1.1 since distributions of both positive and negative observable emotional expression exhibited Poisson distribution. Poisson distribution is better suited to evaluation of data that are skewed and non-negative; it is typically the preferred distribution model to employ when variables are countable and means frequencies are relatively small. Additionally, over-dispersion command was utilized because data variance was greater than the mean of data.

The level-1 model examined the within-resident variability of residents' emotional expressions throughout the time of day. The level-2 model explained emotional expression differences between residents in terms of cognition and resident characteristics.

Aim 1. Questions 1.3. Are there distinctive trajectory groups in observable emotional expression of PWD during the daytime?

A semiparametric, group-based trajectory modeling strategy (Nagin, 2005) was applied to identify clusters of individuals following similar progressions of observable emotional expression over time. The SAS PROC TRAJ was used to group similar positive and negative emotional expression trajectories, respectively. PROC TRAJ was specially designed for use in research seeking to describe the trajectory, or pattern, of change over time in the dependent variable; more specifically, it was created to facilitate the answering of questions concerned with multiple distinct patterns of change over time (Jones, Nagin, & Roeder, 2001). A series of models containing from two to six groups was systematically examined and compared; each group contained a linear, a quadratic, and a cubic term. Additionally, it was necessary to specify the general distributional form of the outcome variable (censored normal, Poisson or binary), which for a summed survey such as the observable emotional expression is most closely matched using a censored normal distribution. Model fit in PROC TRAJ is judged using the Bayesian information criterion (BIC) because it incorporates model complexity and overall fit, and penalizes complicated solutions. Values for the BIC are negative, and better fit is indicated by values closer to 0.

Aim 2. Question 2.1. Do patterns of positive observable emotional expression differ between wanderer s and non-wanderers?

Aim 2. Question 2.2. Do patterns of negative observable emotional expressions differ between wanderers and non-wanderers?

Aim 2 tested two questions, which focused on the differences of observable emotional expression patterns between wanderers and non-wanderers. Fisher's exact test was performed to answer aim 2, since both independent variables and the dependent variable were person-level categorical variables, and the sample size was small.

Aim 3. Question 3.1. How does observable emotional expression relate to wandering of PWD?

HLM approach was used to answer question 3.1 because of the distribution of wandering rates. The intercepts and slopes of Poison regressions of wandering rate predicted by positive and negative observable emotional expression were computed for each participant (level-1). It was necessary to adjust for variation in the length of the observation periods; accordingly the number of hours of each observation was indicated as variable exposure (Raudenbush & Bryk, 2002).

Aim 3. Question 3.2. After controlling for cognition, resident characteristics, and time of day, does observable emotional expression predict wandering of PWD?

HLM was used in a fashion on similar to that employed in answering aim 1 question 1.1. A variable-exposure Poisson model with over-dispersion command was employed, due to the distribution of wandering. By using a two-level model, we can see whether different residents show systematic differences in the strength of the relationship between observable emotional expressions and a dependent variable (i.e., wandering rate), controlling for the effects of residents' cognition and characteristics.

Human Subjects

The parent project was reviewed by, and received full approval of the Health Science Institutional Review Board (IRB-Health) of the University of Michigan. To assure confidentiality of participants, identifiers were deleted from all databases. All raw data and videotapes were stored in a locked cabinet. Electronically stored data (e.g. coding data) were saved on a secure website managed by the University of Michigan School Of Nursing. Only the research team was able to access all data. While the data for this study were incorporated into a larger parent project that includes identifiable private information, no such information was included for my study. Thus, this study is not regulated by the IRB.

CHAPTER IV
RESULTS

This chapter presents the findings of this study in four sections. The first section describes sample characteristics. The remaining three sections present findings of the three aims and research questions.

Sample Characteristics for Aim 1 and Aim 2

For aim 1 and aim 2, only nursing home residents who had completed twelve scheduled observations in the parent study were chosen; these prior encounters ensured a sufficient number of observations to capture each participant's emotional variation. A total of 30 people completed these twelve emotional expression observations. Table 4.1 summarizes the residents' characteristics. The majority of participants were women (73%) and Caucasian (80%), with a mean age of 83.97 years. Around 67% of participants resided in nursing homes; 70% of participants ambulated independently. The mean score of MMSE was 6.93, with range of -1 to 21.

Table 4.1. Residents' Characteristics (N=30)

Variable	Label	N (%)	Mean (SD)
Age			83.97 (5.77)
Gender			
	Male	8 (26.7)	
	Female	22 (73.3)	
Education	Less than 7 years of school	1 (3.7)	
	Junior and/or partial high school	6 (22.2)	
	High school	14 (51.9)	
	Partial college and above	6 (22.2)	
Race			
	Caucasian	24 (80.0)	
	African American	6 (20.0)	
Facility Type			
	Nursing home	20 (66.7)	
	Assisted living	10 (33.3)	
Mobility			
	Independent	21 (70.0)	
	Assisted	9 (30.0)	
MMSE			6.93 (7.52)

Aim 1: Explore Emotion in PWD during the Daytime

Aim 1 was to explore emotional expression in PWD during the daytime. The outcomes of Aim 1 are presented as follows: (1) result of descriptive analyses for emotional expression; (2) correlations among emotional expressions; (3) variations of emotional expression by resident characteristics; and (4) trajectory groups in emotional expression over the daytime period.

Description of Emotional Expression

As seen Table 4.2, PWD showed 13.5 episodes of positive emotional expression (PEE) per observation; only 1.57 episodes of negative emotional expression (NEE) were noted per observation. Since each observation period is 20 minutes, PWD showed 40.5 episodes of PEE per hour and 4.71 episodes of NEE per hour. Among three subscales of PEE, episodes of positive facial emotional expression were the most observed PEE (5.89±5.88). Among three subscales of NEE, episodes of negative body/ posture emotional expression were the most observed NEE (1.00±1.71).

Table 4.2. Summary of Emotional Expression

	Overall mean frequency		Number of peak	
	Mean±SD	Range	Mean±SD	Range
Positive facial emotional expression	5.89±5.88	0.00-38.50	2.77±0.82	1.00-4.00
Positive verbal emotional expression	1.91±3.00	0.00-22.71	2.73±0.98	0.00-5.00
Positive body/ posture emotional expression	5.72±5.26	0.00-28.80	2.83±0.70	2.00-4.00
Sum of positive emotional expression	13.51±12.49	0.00-90.01	2.80±0.89	1.00-5.00
Negative facial emotional expression	0.44±.86	0.00-9.75	1.97±0.96	0.00-3.00
Negative verbal emotional expression	0.13±.63	0.00-15.88	1.13±1.04	0.00-4.00
Negative body/ posture emotional expression	1.00±1.71	0.00-35.00	2.60±0.81	1.00-4.00
Sum of negative emotional expression	1.57±2.26	0.00-50.88	2.60±0.62	2.00-4.00

The number of peaks was calculated from the number of observations, which displayed a high observation (above participant median) flanked by two lower observations. The average number of peaks for PEE was 2.80 (SD±0.89), with a range from 1.00 to 5.00; the average number of peaks for NEE was 2.60 (SD±0.62), with a range from 2.00 to 4.00. In addition, maximum peak time of PEE occurred in the afternoon for almost 67% of participants; maximum peak time of NEE occurred in the afternoon for almost 41% of participants (Table 4.3).

Table 4.3. Maximum Peak Time Period of PEE and NEE

	PEE (%)	NEE (%)
Maximum peak time period		
Morning: 8:00am-11:59am	13.3	21.9
Afternoon:12:00pm4:59pm	66.7	40.6
Early evening: 5:00pm-8:00pm	20.0	40.6

Correlations among Emotional Expressions

Table 4.4 presents correlations among six emotional expressions were examined. Positive facial emotional expression was significantly correlated with positive verbal emotional expression (r=.32) and positive body /posture emotional expression (r=.96). Negative body /posture emotional expression was positively correlated with positive facial emotional expression (r=.48), positive verbal emotional expression (r=.18), and positive body /posture emotional expression (r=.52). However, there was no correlation among negative emotional expressions (i.e., negative facial emotional expression, negative verbal emotional expression, and negative body /posture emotional expression).

Table 4.4. Correlation among Six Emotional Expressions

	1	2	3	4	5
1. Positive facial emotional expression					
2. Positive verbal emotional expression	$.32^{**}$				
3. Positive body/ posture emotional expression	$.96^{**}$	$.35^{**}$			
4. Negative facial emotional expression	-.02	-.07	-.03		
5. Negative verbal emotional expression	.01	$.19^{**}$	.06	.09	
6. Negative body/ posture emotional expression	$.48^{**}$	18^{**}	$.52^{**}$	.03	.01

Note. $^{*}p<.05$, $^{**}p<.01$

Observable Emotional Expression by Resident Characteristics, Cognition, and Time of Day

The dependent variables of Aim 1 were PEE and NEE; independent variables were gender (0=male, 1=female), age, ethnicity (0=Caucasian, 1=other), education (1= junior high school or less, 2=high school, 3=college or higher), mobility (0=independent, 1=assisted), cognition (MMSE score), and time of day (military time-8). As described above in the method section, HLM Poisson regression with over dispersion was chosen as an analytical approach to account for distribution of dependent variables; this choice also yield more robust estimates than ordinary least-squares regression when nested data were applied (Raudenbush & Bryk, 2002). For the purpose of multivariate analysis, two dummy variables for education were created and (military time -8) was used as a time of day variable in order to permit estimation of an intercept at 8 am (base line).

To choose the model that provides the best fit to the observed data, the step-up strategy was selected. This approach is outlined in Raudenbush and Bryk (Raudenbush &

Bryk, 2002). A summary of the step-up strategy is as follows: 1) start with an "unconditional" (or means-only); 2) build the model by adding level-1 covariates to the level-1 model; and then 3) build the model by adding level-2 covariates to the level-2 model. The final model specifications of the 2-level HLM Poisson regression for PEE and NEE are presented in Table 4.5.

Table 4.5. Model Specifications of 2-Level HLM Poisson Regressions

Model for PEE (t=observation, i=resident)
Level-1: $\text{Log}\,[PEE_{ti}] = \pi_{0i} + \pi_{1i}\,(\text{Time of day}_{ti}) + \varepsilon_{ti}$
Level-2: $\pi_{0i} = \beta_{00} + \beta_{01}(\text{Gender})_j + \beta_{02}(\text{Mobility})_j + \gamma_{0i}$
$\pi_{1i} = \beta_{10} + \gamma_{1i}$
Model for NEE (t=observation, i=resident)
Level-1: $\text{Log}\,[NEE_{ti}] = \pi_{0i} + \varepsilon_{ti}$
Level-2: $\pi_{0i} = \beta_{00} + \beta_{01}\,(\text{Gender})_j + \beta_{02}(\text{Age}_i\text{-Age.}) + \beta_{03}(\text{Education\_High school})$
$+ \beta_{04}\,(\text{Education\_College or higher}) + \gamma_{0i}$

Log PEE values were modeled as a function of the time of day at level-1 (observation) with gender and mobility at level-2 (person). Specifically, the level-1 model examined the within-resident variability of residents' positive emotional expression to the time of day. The level-2 model explained differences between residents in terms of gender and mobility. This modeling means that within-resident intercepts (π_0) of each individual vary with the gender and mobility of a resident. In addition, the slope of time of day (π_1) was modeled as relating to individual characteristics of the residents.

Similarly, log NEE values were modeled as a function of gender, age, and education at level-2. There was no significant level-1 predictor. Age was centered at grand means, indicating that the β_0 is the predictive score of an individual who is male, whose formal education ended at or before junior high school, and whose age value equals the grand mean. When grand-mean centering is used, the correlation between intercept and slope estimates across groups is reduced (Hofmann & Gavin, 1998). This reduction of the covariation between the random intercepts and slopes can help to reduce potential level-2 estimation problems due to multicollinearity (Cronbach, 1987).

Table 4.6 contains the two-level Poisson HLM results for PEE. The estimated fixed effects are presented in the top section; random effect results are presented at the bottom. With each passing hour of the day, PWD showed more PEE by 5% (1.05-1), while other variables were held constant. Residents who need assistance showed more positive emotional expression than those who are independent ambulators, when other variables were held constant. Taking into account patient need for assistance increased the expected number of PEE by 37% (1.37-1), after controlling for gender and time of day.

Table 4.6. Two-Level Poisson HLM for PEE

Fixed effect	**Coefficient**	**Standard Error**	**RR (CI)**
Intercept	2.16^{**}	0.17	8.71 (6.16-12.32)
Observation-level predictors			
Time of day	0.05^{**}	0.01	1.05 (1.02-1.08)
Person-level predictors			
Gender (Female)	0.28	0.16	1.33 (0.94-1.87)
Mobility (Assisted)	0.32^{*}	0.15	1.37 (1.00-1.89)
Random effect	**Variance**	χ^2	***P***
Intercept	0.02	30.80	0.08
Time of day	0.00	24.76	0.36
Level-1 variance	7.92		

Note. RR: ratio rate; CI: confidence interval; $^{*}p<.05$, $^{**}p<.01$

As can be seen from Table 4.7, females expressed more negative emotion than did males. Specifically, compared to males, females showed more NEE by 85% (1.85-1), when other variables were held constant. Age increased in one unit from its grand mean, as the expected frequency of NEE increased by 3% (1.03-1). Residents with some college education or more were 46% less likely to show NEE (1-0.54) than residents who had a junior high school education or less.

Table 4.7. Two-Level Poisson HLM for NEE

Fixed effect	**Coefficient**	**Standard Error**	**RR (CI)**
Intercept	0.04	0.22	1.04 (0.66-1.66)
Person-level predictors			
Gender (Female)	0.62*	0.23	1.85 (1.15-2.99)
Age	0.03*	0.01	1.03 (1.01-1.06)
Education (High School)	-0.21	0.20	0.81 (0.53-1.22)
Education (College or higher)	-0.62*	0.25	0.54 (0.32-0.91)
Random effect	**Variance**	χ^2	***P***
Intercept	0.14	66.32	<0.01
Level-1 variance	1.34		

Note. RR: ratio rate; CI: confidence interval; $^{*}p<.05$, $^{**}p<.01$

Trajectory Groups in Observable Emotional Expression of PWD during the Daytime

In order to visualize whether or not there were several trajectory groups in observable emotional expression, it was necessary to plot frequencies of PEE and NEE separately for each participant, and to calculate each participant's median values across all twelve observations. Figure 4.1 is a representative example, showing one participant's data. Common patterns of PEE and NEE across participants, generated from data gathered from 30 figures, were observed. It is obvious that although some participants stayed flat, others fluctuated.

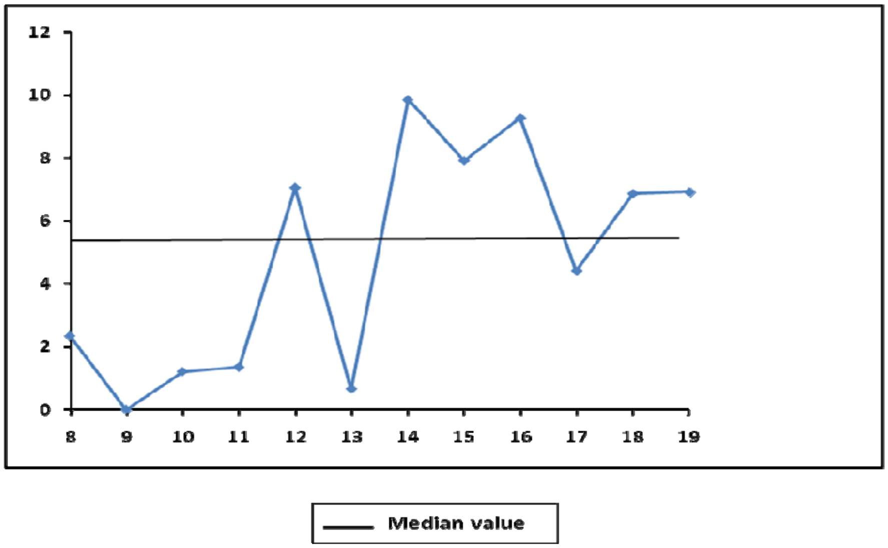


Figure 4.1. Case Example of Hourly Distributions for PEE

In order to statistically identify trajectory groups in observable emotional expression, the author employed a group-based modeling approach. SAS PROC TRAJ analysis was completed with one to four trajectory solutions. The best solutions for positive emotional expression (PEE) and negative emotional expression (NEE) were then selected. Solutions were evaluated using Bayesian Information Criterion (BIC). Although the BIC is a tool which is often used in model selection, the BIC does not always provide the best number of groups (Broadbent, Thomson, & Poulton, 2008; Mulvaney, Lambert, Garber, & Walker, 2006). The number of groups should balance with the interests of parsimony (Broadbent, Thomson, & Poulton, 2008). BIC solution scores for different numbers of groups are listed in Table 4.8. There are two BIC scores, one based on the total number of participants and the other based on the total number of observations. For PEE, the three-group model fits best; for NEE, the three-group model has the best fit. Although the three groups were marginally better for NEE as indicated by the BIC, the two trajectory groups were selected because a two-trajectory solution was more parsimonious.

Table 4.8. Using BIC to Select a Model Having the Optimal Number of Groups

	PEE		NEE	
No. of groups	BIC (N=360)	BIC (N=30)	BIC (N=360)	BIC (N=30)
1	-1404.17	-1397.96	-695.63	-689.41
2	-1400.86	-1388.43	-683.84	-673.90
3	-1401.37	-1385.22	-685.49	-666.86
4	-1417.14	-1392.29	-700.21	-675.36

The parameter estimates for these models are displayed under Model 1 (PEE) and Model 2 (NEE) in Table 4.9. The results showed that there were three groups with distinctive trajectories for PEE, and there were two groups with distinctive trajectories for NEE. For PEE, Group 1 was defined by the linear parameter; this group was marginally significant (p=0.068). Group 2 and Group 3 were defined by the cubic parameter because the linear and quadratic terms are less significant (p=0.001, p=0.038, respectively). For NEE, Group 1 was defined by the linear parameter; the other group was defined by the cubic parameter. However, Group 1 of NEE was not significant (p=0.199).

Table 4.9. Parameter Estimates for Group Trajectories and Group Membership

Group	Parameter	Model 1 (PEE)			Model 2 (NEE)		
		Estimate	SE	*P*	Estimate	SE	*P*
1	Intercept	3.80	3.39	0.263	0.56	0.39	0.150
	Linear	**0.45**	**0.25**	**0.068**	**0.04**	**0.03**	**0.199**
2	Intercept	251.72	89.00	0.005	-69.50	27.35	0.012
	Linear	-63.87	21.38	0.003	17.51	6.48	0.007
	Quadratic	5.32	1.65	0.001	-1.33	0.49	0.007
	Cubic	**-0.14**	**0.04**	**0.001**	**0.03**	**0.01**	**0.007**
3	Intercept	-162.88	95.97	0.091			
	Linear	45.73	23.14	0.048			
	Quadratic	-3.62	1.78	0.043			
	Cubic	**0.09**	**0.04**	**0.038**			

SE: standard error

The proportion of residents in each group and the group trajectories for the three groups estimated using Model 1 (PEE) are depicted in Figure 4.2. This figure (solid lines are actual curves, while broken lines represent predicted curves) shows that Group 1 comprising about 51% of the residents, was labeled as a low stable group of PEE. The trajectory for this group was basically flat, and residents in this group consistently expressed little positive emotional expression. Group 2 comprised about 27% of the residents. This group of residents can be characterized as having a fluctuating, but afternoon peaking of PEE. Specifically, low peak time was around 10 am; high peak time was around 6 pm, which was after their dinner time. Group 3, accounting for 22% of the residents, was made up of residents who had high PEE in the morning and low PEE in the afternoon. This group also had higher average PEE than the other two groups. Group 3 was labeled as having fluctuating, which peaked during the morning.

Figure 4.2. Predicted and Observed PEE for Each Trajectory Group

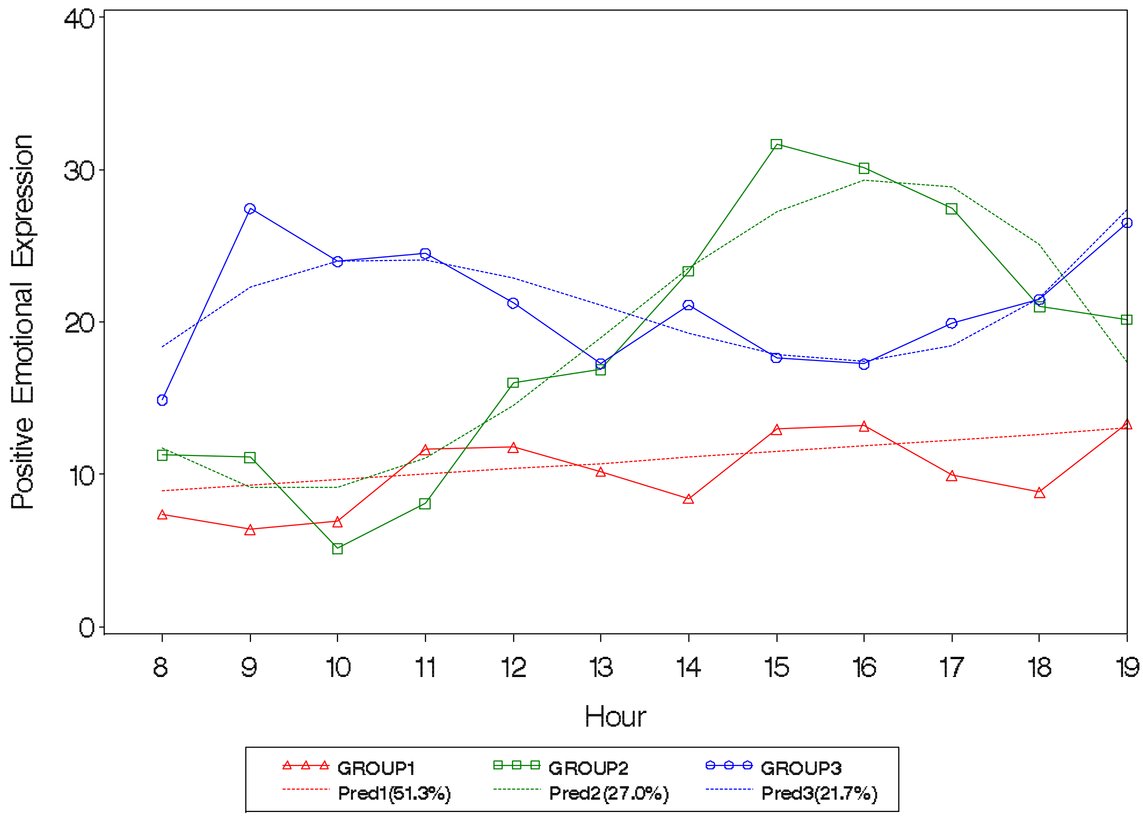
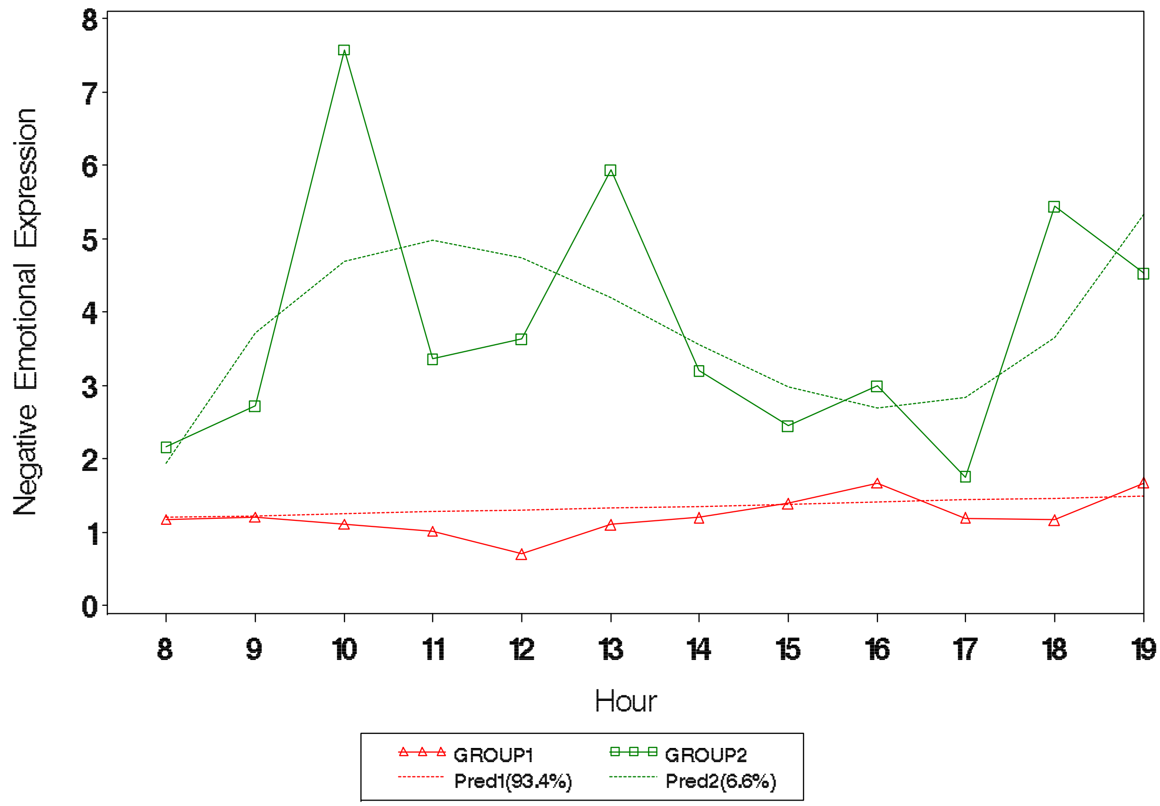


Figure 4.3 shows both predicted and observed negative emotional expression (NEE) in Group 1 and Group 2. Group 1, accounting for 93% of the residents, displayed low stable levels of NEE. The trajectory of this group was flat, and it continuously showed low NEE. Group 2, constituting about only 7% of the residents, showed fluctuation in NEE, and displayed higher NEE than Group 1 did. Specifically, residents of Group 2 showed high NEE in the morning, low NEE in the afternoon, and high NEE again in the early evening.

Figure 4.3. Predicted and Observed NEE for Each Trajectory Group



Emotional Expression Pattern by Resident Characteristics

Comparisons of emotional expression pattern were made using the two-tailed Fisher's exact test. The study tracked, as appropriate, continuous variables (i.e., MMSE and age), using the Kruskal-Wallis test (see Table 4.10) or the Mann-Whitney U test (see Table 4.10), and categorical variables (i.e., gender, ethnicity, education, mobility, and facility). As can be seen Table 4.10, no differences were found among three PEE groups.

Table 4.10. PEE Pattern Differences by Resident Characteristics

	Group 1 n (%)	Group 2 n (%)	Group 3 n (%)	*K-W/Fisher's*	*P*
Gender					
Male	5 (33.3)	2 (22.2)	1 (16.7)	*.69*	.76
Female	10 (66.7)	7 (77.8)	5 (83.3)		
Ethnicity					
Caucasian	13 (86.7)	6 (66.7)	5 (83.3)	*1.53*	.51
Other	2 (13.3)	3 (33.3)	1 (16.7)		
Education					
Junior high school	3 (25.0)	3 (33.3)	0 (0.0)	*3.61*	.49
High school	7 (58.3)	3 (33.3)	4 (66.7)		
College or above	2 (16.7)	3 (33.3)	2 (33.3)		
Mobility					
Independent	12 (80.0)	5 (55.6)	4 (66.7)	*1.77*	.44
Assistant	3 (20.0)	4 (44.4)	2 (33.3)		
Facility					
Nursing home	10 (66.7)	7 (77.8)	3 (50.0)	*1.30*	.46
Assisted living	5 (33.3)	2 (22.2)	3 (50.0)		
Age	83.9±6.2	82.6±5.9	86.3±4.3	*.24*	.89
MMSE	6.7±7.8	5.13±4.5	10.4±10.6	*.71*	.70

Note. K-W: Kruskal-Wallis test; Fisher's: Fisher's exact test

For NEE groups, the MMSE score was marginally different between Group 1 and Group 2 (p=0.09). Otherwise, no differences in resident characteristics were found between the two NEE groups (Table 4.11).

Table 4.11. NEE Pattern Differences by Resident Characteristics

	Group 1	Group 2	M-U/Fisher's	P
	n (%)	n (%)		
Gender				
Male	8 (28.6)	0 (0.0)	.79	.60
Female	20 (71.4)	2 (100.0)		
Ethnicity				
Caucasian	22 (78.6)	2 (100.0)	.54	1.00
Other	6 (5.6)	0 (0.0)		
Education				
Junior high school	6 (24.0)	0 (0.0)	1.15	1.00
High school	13 (52.0)	1 (50.0)		
College or above	6 (24.0)	1 (50.0)		
Mobility				
Independent	20 (71.4)	1 (50.0)	.41	1.00
Assistant	8 (28.6)	1 (50.0)		
Facility				
Nursing home	19 (67.9)	1 (50.0)	.27	1.00
Assisted living	9 (32.1)	1 (50.0)		
Age	83.6 (5.7)	89.0 (5.7)	16.0	.32
MMSE	7.56 (7.5)	-1.0 (0.0)	7.0	.09

Note. M-U:Mann-Whitney U test; Fisher's: Fisher's exact test

Aim 2: Examine the Relationship between Patterns of Emotion and Wanderers among PWD

Aim 2 seeks to examine the observable emotional expression differences between wanderers and non-wanderers. To aid in that examination, the author selected to use a Fisher's exact test since more than one cell had an expected count of less than 5, and both the independent and dependent variables were categorical variables. The wanderer variable was derived from the wandering typology variable (measuring classic, moderate, subclinical, and not-clustered subjects). Classic, moderate, and subclinical subjects were aggregated as “wanderer”; those not-clustered were labeled “non-wanderer” .

Positive Emotional Expression and Wanderer

No difference was found between wanderers and non-wanderers in their PEE patterns (Table 4.12).

Table 4. 12. PEE Pattern Difference between Wanders and Non-wanderers

	Wanderer	Non-wanderer	*P*
	n (%)	n (%)	
Group 1	11 (45.8)	4 (66.7)	.23
Group 2	9 (37.5)	0 (0.0)	
Group 3	4 (16.7)	2 (33.3)	

Negative Emotional Expression and Wanderer

As was the case with their PEE patterns, no difference found between wanderers and non-wanderers in their NEE patterns (Table 4.13).

Table 4. 13. NEE Pattern Difference between Wanders and Non-wanderers

	Wanderer	Non-wanderer	*P*
	n (%)	n (%)	
Group 1	2 (8.3)	0 (0.0)	1.00
Group 2	22 (91.7)	6 (100.0)	

Aim 3: Examine the Relationship between Frequencies of Emotion and Wandering in PWD

Aim 3 focused on examining the association between frequencies of emotion and wandering. It included all residents who participated in this study, even if they did not participate in twelve complete observations. Among 142 participants with 1485 observations, 115 residents representing 1105 observation sessions were included due to missing data on level-2 control variables (i.e., gender, age, ethnicity, mobility, and education). Descriptive statistics of level-1 and level-2 variables in the HLM regression equations are presented in Table 4.14.

Table 4.14. Descriptive Statistics of Level-1 and Level-2 Variables

	Variable Name	N	Mean	SD	Range
Level-1					
	Wandering_Rate	1105	0.95	2.32	0.00-19.00
	Duration (hour)	1105	0.33	0.03	0.09-0.38
	PEE	1105	14.16	12.56	0.00-90.01
	NEE	1105	1.54	1.83	0.00-13.33
	Time of day (Military time-8)	1105	5.53	3.42	0.00-12.00
Level-2					
	Gender	115	0.77	0.43	0.00-1.00
	Age	115	85.53	6.37	68.00-98.00
	Ethnicity	115	0.16	0.36	0.00-1.00
	Mobility	115	0.29	0.45	0.00-1.00
	Education_high school	115	0.41	0.49	0.00-1.00
	Education_college or higher	115	0.36	0.48	0.00-1.00
	MMSE	115	7.26	7.18	-1.00-23.00

Frequencies of Observable Emotional Expression (i.e., Positive Emotion and Negative Emotion) and Wandering Rates

Compared to the unconditional model that had only a random intercept with no predictor, frequencies of PEE and NEE centered around group means, and added to the variable-exposure Poisson regression model with over-dispersion. When a group mean displayed centering, the level-1 intercept variance was found to be the same as the between-group variance in the outcome variable. Thus, the level-2 regression coefficients represent the group level relationship between the level-2 predictor and the outcome variable, when group mean centering is adopted (Hofmann & Gavin, 1998). β_0 is the predictive score of an individual whose PEE and NEE values equal the means of PEE and NEE. The model specification for level-2 Poisson HLM regression of wandering rate is presented in Table 4. 15.

Table 4. 15. Model Specifications of 2-Level HLM Poisson Regressions (Emotional Expression only Model)

Model for Wandering frequency (t=observation, i=resident)
Level-1: Log [$\text{Wandering\_Rate}_{ti}$]= $\pi_{0i} + \pi_{1i} (PEE_{ti}-PEE_{.i}) + \pi_{2i} (NEE_{ti}-NEE_{.i}) + \varepsilon_{ti}$
Level-2: $\pi_{0i} = \beta_{00} + \gamma_{0i}$
$\pi_{1i} = \beta_{10}$
$\pi_{2i} = \beta_{20}$

The results of Poisson HLM for wandering frequency are presented in Table 4. 16. PEE and NEE were statically significant predictors of wandering rate. Specifically, when NEE was the same as the individual NEE mean, 1 unit increase of PEE from the individual PEE mean resulted in a 3% (1.03-1) increase in wandering rate (wandering frequency/hr). When PEE was same as the individual PEE mean, a 1 unit increase in NEE above the individual NEE mean resulted in an 11% (1-0.89) decrease in wandering rate.

Table 4. 16. Two-Level Poisson HLM for Wandering Rates

Variable	Coefficient	Standard Error	RR (CI)
Intercept	0.65^{**}	0.12	1.91 (1.51-2.40)
Observation-level predictors			
Positive emotional expression	0.03^{**}	0.01	1.03 (1.02-1.04)
Negative emotional expression	-0.12^{**}	0.04	0.89 (0.83-0.96)
Random effect	**Variance**	**d.f.**	χ^2
Intercept	1.03	114	701.55^{**}
Level-1 residual	2.69		

Note. RR: ratio rate; CI: confidence interval; $^{*}p<.05$, $^{**}p<.01$

Effects of Emotional Expression Frequencies, Cognitive Impairment, Time of Day, and Resident Characteristics on Wandering Rates

Using the emotional expression only model (Table 4.16), the step-up strategy was used in order to choose the model best suited to providing an optional both fit with the observed data, and finding covariates between emotional expression frequencies and wandering rates. In keeping with this strategy, three models are presented in Table 4.17. Model 1 includes time of day variable, which is the sole level-1 predictor linking emotional expression and wandering. Random effect of time of day was included, because its effects were shown to be random. Model 2 includes MMSE to level-2 to permit examination of whether or not both emotional expression and cognition have an effect on wandering. Model 3 includes other possible level-2 predictors, using an exploratory analysis approach (Bryk & Raudenbush, 1992). The predictor which was significant was the best candidate for inclusion in the level-2 equation. Among five potential variables (i.e., gender, age, race, education, and mobility), gender, age, and education were included after resulting of the above procedure had been obtained.

Table 4. 17. Model Specifications of 2-Level HLM Poisson Regressions (Final Model)

Model 1	Level 1:	Log [Wandering Rate$_{ti}$]=π_{0i}+ π_{1i} (PEE$_{ti}$-PEE$_{.i}$) + π_{2i} (NEE$_{ti}$-NEE$_{.i}$) + π_{3i} (Time-8$_{ti}$)+ ε_{ti}
	Level 2:	π_{0i}= β_{00} + γ_{0i} π_{1i}= β_{10} π_{2i}= β_{20} π_{3i}= β_{30} + γ_{3i}
Model 2	Level 1:	Log [Wandering Rate$_{ti}$]= π_{0i}+ π_{1i} (PEE$_{ti}$-PEE$_{.i}$) + π_{2i} (NEE$_{ti}$-NEE$_{.i}$) + π_{3i} (Time-8$_{ti}$)+ ε_{ti}
	Level 2:	π_{0i} =β_{00} + β_{01}(MMSE $_i$-MMSE.) + γ_{0i} π_{1i}= β_{10} π_{2i}= β_{20} π_{3i}= β_{30} + γ_{3i}
Model 3	Level 1:	Log [Wandering Rate$_{ti}$]= π_{0i}+ π_{1i} (PEE$_{ti}$-PEE$_{.i}$) + π_{2i} (NEE$_{ti}$-NEE$_{.i}$) + π_{3i} (Time-8$_{ti}$)+ ε_{ti}
	Level 2:	π_{0i} =β_{00} + β_{01}(MMSE $_i$-MMSE.)+ β_{02}(GENDER) + β_{03}(AGE $_i$ -AGE.)+ β_{04} (Education_Highschool) + β_{05} (Education_College & Higher) + γ_{0i} π_{1i}= β_{10} π_{2i}= β_{20} π_{3i}= β_{30} + γ_{3i}

The results of these regression models are presented in Table 4. 18. The estimated fixed effects are presented in the top section whereas the random effect results are presented at the bottom. Model 1 shows that time of day was a significant predictor. Model 2 shows that MMSE, too, was a significant predictor. As a large proportion of the variance in the expected rate of wandering, up to 72.2% [e.g. 2.55/(2.55+0.98) for model 3] was explained by the variables at observation level (level-1).

Model 3 (Final model) illustrates that the following values were obtained: where each person of PEE and NEE was equal to the each individual mean; time of day was 8 am; MMSE score was equal to the grand mean (7.26); the resident was male; age was equal to the grand mean (85.53); and maximum education level was junior high school or less, the geometric mean of wandering rate was 1.08/hour, which was the value of the exponential intercept. Therefore, average wandering frequency per hour is 1.08. Controlling for other predictors, PEE and time of day had a positive influence on the wandering rate, whereas NEE, MMSE score, and age had a negative influence on the wandering rate. Specifically, when PEE increased one unit from its group mean (each individual mean), the expected rate of wandering increased by 3% (1.03-1); when NEE increased one unit from its group mean (each individual mean), the expected rate of wandering decreased by 11% (1-0.89). A resident's being one year older than grand mean (85.53) decreased the expected rate of wandering by 5% (1-0.95). An increase in the MMSE score one point over that of the grand mean (7.26) decreased the expected hourly wandering rate by 6% (1-0.94).

Table 4.18. Two-Level Poisson HLM for Wandering Rates

Variable	Model 1		Model 2		Model 3	
	B (SE)	RR (CI)	B (SE)	RR (CI)	B (SE)	RR (CI)
Intercept	0.39*(0.16)	1.47 (1.08-2.00)	0.32* (0.16)	1.38 (1.00-1.89)	0.08 (0.31)	1.08 (0.59-2.00)
Observation-level predictors						
PEE	0.03**(0.01)	1.03 (1.02-1.04)	0.03**(0.01)	1.03 (1.02-1.04)	0.03**(0.01)	1.03 (1.02-1.04)
NEE	-0.13** (0.04)	0.88 (0.82-0.95)	-0.13** (0.04)	0.88 (0.82-0.95)	-0.12** (0.04)	0.89 (0.83-0.95)
Time of day	0.04* (0.02)	1.04 (1.01-1.08)	0.05** (0.02)	1.05 (1.02-1.09)	0.04* (0.02)	1.04 (1.01-1.08)
Person-level predictors						
MMSE			-0.06** (0.02)	0.94 (0.91-0.97)	-0.07** (0.02)	0.94 (0.91-0.97)
Gender (female)					0.12 (0.27)	1.13 (0.66-1.94)
Age					-0.05** (0.02)	0.95 (0.92-0.99)
Education (High school)					0.52 (0.29)	1.68 (0.95-2.97)
Education (College or higher)					-0.12 (0.30)	0.89 (0.49-1.62)
Random effect	**Variance**	χ^2	**Variance**	χ^2	**Variance**	χ^2
Intercept	1.27	276.14**	1.28	263.15**	0.98	194.29**
Time of day	0.00	96.27	0.00	96.18	0.00	97.34
Level-1	2.48		2.52		2.55	

Note. SE: standard error; RR: ratio rate; CI: confidence interval; $^{*}p$<.05, $^{**}p$<.01

CHAPTER V
DISCUSSION

Wandering behavior is a common dementia-related locomotive behavior of people with dementia (PWD) that has recently received increased attention. Among the factors that influence wandering behavior, this study focused on emotion and cognition. Three specific aims were examined: (1) variation of emotional expression in the daytime period; (2) relationship between emotional patterns and the presence of wandering; and (3) relationship between emotional frequencies and wandering frequencies. This chapter includes a discussion of study's findings, its limitations, recommendations for the future study, and implications for the practice of nursing.

Discussion of Findings

Emotional Expressions in PWD

The results of the study provided evidence that PWD displayed a considerable range of emotional expressions. Specifically, there were 40.5 episodes of positive emotional expression (PEE) and 4.71 episodes of negative emotional expression (NEE) per hour, even though the average MMSE score of participants was 6.93. This result supported previous studies which suggested that PWD retain the ability to express positive and negative emotions (Kolanowski, Hoffman, & Hofer, 2007; Magai et al., 1996; Yao & Algase, 2008). In particular, Magai and colleagues (1996) reported that people with even mid- to late- stage dementia showed both positive and negative emotional expressions such as interest, happiness, sadness, fear, and anger. Moreover, it is uncertain whether PWD had lower emotional expressions than healthy elderly people, because the cross-sectional study lacked a control group. Even though emotional expressions of PWD were not as frequent as they were among healthy elderly people, this observation might be related to low levels of social interaction in nursing home settings (Magai & McFadden, 1995).

Somewhat surprisingly, PWD expressed more positive emotion than negative emotion, contrary to the popularly held belief that PWD were usually anxious, angry, or depressed. This result is consistent with a recent case study by Kolanowski and colleagues (2002), who also reported displays of participant's happiness. More specifically, the mean score of positive affect was 13 times that of the negative affect mean score.

This study showed significant correlations among positive emotional expression, but no strong correlations among negative emotional expressions. At least one study also showed same results among healthy adults (Lawton, Kleban, Rajagopal, & Dean, 1992). Lawton (1996) explained these results using the dual-channel hypothesis. The dual-channel proposed a statement that positive affect was related to external events; negative affect was related to internal engagement (Lawton, Van Haitsma, & Klapper, 1996). Unexpectedly, even though earlier studies had noted independence between positive affects and negative affects (Warr, Barter, & Brownbridge, 1983), this study found positive correlations between positive emotional expressions and negaitve body/ posture expression. Diener and Emmons (1985) also reported that positive and negative emotional expressions were likely to occur together over short time periods. Although it is not applied to all PWD, one possible explanation of the cross-relationship is the continued presence of vigor among PWD (Lawton, Van Haitsma, & Klapper, 1996). More explicitly, a certain amount of vigor is necessary to show both positive and negative affect among PWD (Lawton et al., 1996).

Observable emotional expressions were partially explained by resident characteristics and time of day. While time of day and mobility were significant predictors of PEE, gender, age, and education were related to NEE. Specifically, females showed more of both PEE and NEE than did males. Several studies reported that women are more likely to be emotional than men, although their samples were limited to healthy adults (Bagozzi, Wong, & Yi, 1999; Feldman, 1995; Lutz, 1996). Notably, Bagozzi and colleagues (1999) reported that this pattern is the same, regardless of cultural differences.

This study showed that age and education were one of the predictors of NEE, but not of PEE. As age increased, so did the frequency of NEE. Even studies on affect among healthy older participants have been inconsistent. For example, Issacowtize & Smith did not find a correlation between age and affect, after accounting for demographic variables, personality, commorbity, general intelligence, and mobility (Isaacowitz & Smith, 2003). A recent study reported that aging is related to greater co-occurrence of both positive and negative emotions (Carstensen, et al., 2010). In addition, cognitive ability has been shown to be negatively correlated with aging (Lindenberger & Baltes, 1997). For PWD, it is more difficult to find a unique age effect, since cognitive impairment is a major symptom of dementia that influences the aging process of PWD. This area of research is not fully examined, and the mechanism connecting age and emotion among PWD remains unknown.

With respect to the effect, if any of increased educational levels, this factor was found to correlate with NEE, but not with PEE. Education was negatively correlated with negative affect becoming pronounced in later life (Meeks & Murrell, 2001; Rhodewalt & Zone, 1989; Smith & Rhodewalt, 1986). In particular, Meeks & Murrell (2001) reported negative affect as a mediator between educational levels and life satisfaction. In other words, higher education levels were associated with lower levels of negative affect, which positively influenced attitudes regarding life satisfaction. Our finding was consistent with their works, even though somewhat different in measure. They treated affect as a personal trait, not as a changeable emotional status. People who had lower educational levels might not be successful in their social or financial positions; this diminished success would likely contribute to significant levels of negative affect (Rhodewalt & Zone, 1989). In addition, highly educated people usually know alternative ways to display their negative emotional responses.

This study showed that time of day was one of the predictors of PEE, but not of NEE. Previous studies have shown that the time of the day is consistently related to PEE, not NEE, even though their subjects were usually young adults (Clark, Watson, & Leeka, 1989; Egloff, Tausch, Kohlmann, & Krohne, 1995; Thayer, 1987).

In addition, cognitive impairment was unrelated to variation in both positive and negative emotional expression. A possible explanation of how PWD manage to preserve emotion regardless of cognitive function lies in how the brain changes in dementia. The basal ganglia, among the key brain areas with respect to emotional functions, is relatively unaffected by the neural degeneration associated with Alzheimer's disease (Eldridge, Masterman, & Knowlton, 2002). While medial temporal lobe atrophy is a hallmark of Alzheimer's disease, subcortical structures are relatively unaffected (Arnold, Hyman, Flory, Damasio, & Van Hoesen, 1991; Lewis, Campbell, Terry, & Morrison, 1987). In addition, abnormal metabolism begins at higher level cortical regions. This means that basal ganglia cannot receive input from higher level cortical processing, but it can receive input from primary sensory regions (Eldridge, et al., 2002). As dementia progresses, the influence of cognition on emotion may weaken. This explanation might support no influence of cognitive impairment on both positive and negative emotional expression.

Trajectory Groups in Observable Emotional Expression of PWD

This study showed that there were significant emotional trajectory variations among PWD; three types of distinctive PEE and two types of NEE were found. Its findings suggested that PWD not only preserve emotion but also exhibit a variety of patterns in doing so. Since PWD tend to focus on "present" due to their cognitive impairment, daily emotional fluctuations could be one of the important factors of their emotional wellbeing (Kolanowski, et al., 2007).

This study appears to be the first study to examine variations of emotion in PWD over daytime periods. Even though no study was found to have examined diurnal variation in emotions among PWD, it should be noted that Kolanowski and colleagues (2007) examined variations of positive and negative emotion in PWD across a 12-day period. They also showed significant within-person variation in positive and negative emotion (approximately 40% to 60%) across days.

For PEE, there were three groups: (1) a low stable group; (2) a fluctuating group displaying afternoon peaking; and (3) a fluctuating group displaying morning peaking. For NEE, there were two groups: (1) a low stable group; and (2) a fluctuating group. These patterns might be related to residents' schedules in nursing home settings. Studies used college student samples showing similar diurnal PEE variations; the authors suggested that a potential reason might be the similar schedules and ages of samples (Clark, et al., 1989; Thayer, 1987; Thayer, et al., 1988). In this study, PWD who were not scheduled to participate in any activities might be likely to belong to a low stable group. On the other hand, among PWD who had been scheduled to interact with other residents or staff might display patterns of emotional expression which were subject to fluctuation.

In the study, PEE showed statistically more distinctive trajectories than did NEE. One possible explanation of this distinction could lie in the relationship between PEE and endogenous circadian rhythms, which are correlated with biological rhythms, which vary with, e.g., body temperature and sleep conditions (Clark, et al., 1989; Moore-Ede, Czeisler, & Richardson, 1983a, 1983b). PEE during daytime hours thus was found to affect individual biological rhythms, and vice versa.

The other possible explanation of this distinction may lie in daytime variations of PEE, which are related to depression. Depression-associated symptoms (e.g., loss of appetite, insomnia, early morning wakefulness, and fatigue) could be a cause of circadian rhythm disturbance (Clark, et al., 1989; Healy & Williams, 1988; Nelson & Charney, 1981). In particular, the symptom of worsening depression is related to low PEE (Clark & Watson, 1988; Clark, et al., 1989; Watson, Clark, & Carey, 1988). For instance, patients with melancholic depression have been shown to be consistently worse in the morning, whereas patients with reactive depression are usually worse in the evening (American Psychiatric Association, 2010). Additionally, physiological needs such as hunger, pain, and constipation may affect emotional expressions of PWD (Hurley et al., 1992).

Unfortunately, there was no clear pattern linking person-level emotional pattern differences with resident characteristics (i.e., gender, ethnicity, education, mobility, facility type, age) and cognition. One reason for the lack of such a finding may be the relatively limited data available. This study did not include emotional experience related variables, such as personality, stress level, and physical health. Another reason for the lack of such a finding may be the study's sample size since; for example, emotional trajectories were created from 360 observations of only 30 residents.

Emotional Expression and Wandering

Emotional patterns did not differ based on whether PWD were wanderers or non-wanderers, whereas emotional frequencies were significantly associated with wandering rates. There could be several possible explanations for insignificant emotional pattern differences between wanderers and non-wanderers. First, observation-level emotional expression frequencies are more important contributing factors to wandering than are person-level emotion patterns. One characteristic of emotion is that it is likely to change rapidly (Scherer, 2005). The NDB model also indicated emotion as a current situational factor influencing dementia-compromised behaviors (Algase, et al., 1996). In light of the conceptual and the theoretical view, it is more relevant to capture emotional expression at the observation level, rather than at the person level.

Second, this study obtained person-level emotional patterns from 30 residents, which is a relatively small sample size. On the other hand, frequent displays of emotional expression furnished observation-level data, which were obtained from 115 residents during over 1000 observation. The sample size and variable level (i.e., person-level vs. observation-level) differences could be one of the reasons that emotional patterns were not a good predictor of whether PWD could exhibit wandering behavior.

Third, since wanderer variable was created by combining three clustered groups (i.e., classic, moderate, and subclinical), specific information about each group was lost.

One of the most important findings of this study was that PEE was associated positively with wandering rate, whereas NEE had an inverse relationship to wandering rate. This result indicates that PWD who are sad or angry tend to sit alone or stay in their rooms for long periods of time, rather than walk around. On the other hand, PWD who are happy or pleasant tend to express their behavioral responses by walking around.

A possible explanation for these observed behavioral differences may lie in the combination effect of personality traits (i.e., one of the background factors) and emotional expression (i.e., one of the proximal factors) on wandering among PWD. Premorbid characteristics of PWD are likely to contribute at least partially to the background factors that influenced on this result. A study by Song and Algase (2008) reported that extroversive personality had a negative relationship with wandering. Their explanation of the negative relationship between extroversive personality and wandering was that those who had a less extroverted personality, viz., who had a more introverted personality, tended to be independent and less social (Song & Algase, 2008).

When less extroverted people experience NEE, their behavioral responses are likely to be more private, and less public. They are likely to spend time alone with negative emotional expression. However, less extroverted PWD might enjoy interacting with other people, when they experience PEE. That is, frequencies of PEE and NEE have been found to function as a moderator of personality impact on wandering rates. The impact on wandering rates of the personalities of PWD might be moderated by the frequencies of PEE and NEE. Residents' emotional expression of their personalities had an impact on outcomes (i.e., wandering rates). More explicitly, when relatively introverted residents are happy (i.e., having a higher level of PEE), they are more likely to wander. Conversely, when these less extroverted residents are angry or unpleasant (i.e., higher levels of negative emotional expression), they are less likely to wander.

Another significant finding is that this study showed wandering to be dependent on the functions of cognition and emotion. It confirmed the LRE-EWD model (Yao & Algase, 2006), which indicates behavior is the outcome of cognitive and emotional processing of information. According to Yao & Algase (2008), wandering is an interrelated response of both emotional reaction and cognition. Emotional reaction is an initial reaction to a stimulus; cognition changes or refines perception of stimulus, emotional reaction, and action impulse, ideally, resulting in an optimal behavior response.

This study also confirmed, as previous studies had shown, that lower MMSE scores were related to more frequent wandering (Algase, Beattie, & Therrien, 2001; Buchner & Larson, 1987; Burns, Folstein, Brandt, & Folstein, 1990; Song & Algase, 2008). This finding supports the model that cognitive impairment is at least partially responsible for wandering behavior. This study also found that younger age had a significant positive influence on wandering rates. This finding was consistent with previous studies that showed younger age to be significantly related to wandering (Schreiner, Yamamoto, & Shiotani, 2000).

Methods

This study used the HLM approach, which is a strong and sophisticated method of analyzing multilevel data (Wu, 1995). In the present analysis, repeated observations of emotional expression and wandering rate represented level-1 data units that were nested within each resident or level-2 unit. The HLM is more accurate than either statistical analyses using repeated measures analysis of variance (ANOVA) or a generalized linear model (GLM), since it provides a more efficient estimation of data representing missing or nonsynchronous observations (Bryk & Raudenbush, 1992).

In addition, a SAS-based procedure for estimating a group-based trajectory model was used to explore patterns of emotional expression over time. Group-based trajectory analysis is an appropriate approach to employ in answering a research question (in this instance, the exploration of distinctive trajectory groups in observable emotional expression of people with dementia during the daytime). This analysis technique is a useful and valid descriptive tool to utilize in investigating patterns of change over time in multiple subgroups within a population (Jones, Nagin, & Roeder, 2001).

This study measured main variables from repeated measured observation data. Although there is growing attention to the accuracy of self-reported emotional well-being of PWD, observational data are regarded as providing more accurate and reliable measurements than self-reports, especially among PWD (Larsen & Fredrickson, 1999).

Limitations

This study contributes to knowledge of not only variation in emotional expression, but also of the relationship between emotion and wandering. However, it was subject to several limitations.

First, its sample size— 30 residents— and location (i.e., Michigan and Pennsylvania) limited the observable range of variations in emotional expression among PWD. However, this finding could be generalized at least in Michigan and Pennsylvania since random cluster sampling was used.

Second, as in the parent study, a cross-sectional study design was used to obtain data over a single time period. This type of study can efficiently indentify association, but cannot demonstrate causal relationships (Levin, 2006). Thus, further longitudinal studies are required to justify any causal inference linking cognition and emotion with wandering behavior.

Third, emotional expressions and wandering were quantified using repeated measured observation data, which provided a more exact measure of frequency for each variable. However, it is questionable whether observed emotional expression actually indicates underlying feeling states.

Fourth, the MMSE was the only measurement of cognition in this study due to data availability. It is good to measure the level of impairment in dementia but not a good measure of different cognitive functions.

Fifth, residents who had engaged in a stable medication regime during the 30 days prior to observation, and remained so throughout the study, were included in the parent study. However, this study did not control types of medication such as antipsychotics, antidepressants, and anticonvulsants.

Last, this is the first study to explore the relationship of emotional expression and cognition to wandering behaviors of PWD. However, other background factors (e.g., personality traits, general health) and proximal factors (e.g., social interaction, physical environment) relating to wandering were not included.

Recommendations for Future Studies

In light of this study is finding and its limitations, several areas are recommended for future study. First, this study found significant variations in emotional expression during the daytime. Besides being associated with time of day, emotional expression may be related to events or activities of daily living (ADL) in nursing homes, such as toileting, bathing, and eating. For example, it is possible that PWD may be more likely to show NEE during toileting or bathing, whereas they may be more likely to show PEE after having eaten a meal. This study was not able to examine the relationship between emotional expression and ADL because the required data were not available. Studies of the relationship between emotional expression, events, and ADL at each observation will provide more specific data which may aid in the design of intervention programs to improve emotional well being of PWD.

Second, this study could not find emotional expression pattern differences by resident characteristics. If further studies were to include affect-related variables (e.g., personality trait, environment, and social interaction), and recruit a larger sample of participants, a better understanding of emotional expression patterns of PWD could result.

Third, this study found that PEE was associated positively with wandering rate, whereas NEE had an inverse relationship to wandering rate. As a potential reason, combination effect of personality traits (i.e., one of the background factors) and emotional expression (i.e., one of the proximal factors) on wandering among PWD was suggested. However, the mechanism by which acts as an emotional expression moderator between personality and wandering has not been established; future studies are therefore required to confirm this moderating effect.

Fourth, this study is the first to examine the relationship of cognition and emotional expression to wandering of PWD. However, the causal relationship could not be shown because the parent study design was cross sectional. Therefore, future longitudinal studies are required to confirm the existence of any causal relationship.

Implications for Nursing Practice

This study provides evidence of the importance in preserving emotion among PWD, as well as the relationship of emotion and cognition to their wandering behavior. Since nursing home staff usually regard emotion of PWD as blunted or dull, they tend to ignore or discount residents' feelings (Magai et al., 1996). The present study showed that PWD expressed both positive and negative emotions, even when frequencies of emotion were lower than those of healthy old adults. Magai and colleagues (1996) attributed this phenomenon to the lack of social stimulation experienced by PWD in institutional settings. Another study also found engagement in activities was associated with better emotional well-being, defined as the balance between PEE and NEE (Chung, 2004). In order to improve the emotional well-being of PWD, nursing home staff should encourage residents to participate in social activities and to interact with other residents and staff.

Wandering behavior is related not only to cognition, but also to emotional expression. Nursing staff need to assess both cognitive function and emotional status of PWD. Following assessment of these factors, nursing staff could create an individualized tailored intervention for each resident; an individualized intervention plan, one addressing both emotional and cognitive functioning, is required if wandering behaviors of PWD are to be reduced. For instance, when someone in the early stages of dementia (i.e., a person who has relatively better cognitive function than someone in the later stages of dementia) experiences a positive emotion, the provision of a structured social activity should be one of the nursing interventions used to prevent wandering. On the other hand, a person in late stage dementia experiencing positive emotion might be provided a one-to-one relationship in an effort to deter wandering. Individualized nursing interventions that take into account a resident's cognition and emotion will contribute to an improved quality of life, as well as a more benign nursing home environment for PWD.

APENDIX A

OBSERVABLE DISPALYS OF AFFECT SCALE (ODAS)

Guidelines for Rating Videotapes

1. Watch the entire videotape without rating
2. Replay the videotape in two-minute intervals. For each interval, mark the amount of time each “facial display” was observed. Complete the observations for “facial displays” before going on to “verbal displays.”
3. Replay the videotape in two-minute intervals looking for positive “verbal displays”. Now observe two-minute intervals for negative “verbal displays” before going on to “body movement/posture displays.”
4. Replay the videotape in two-minute intervals for negative “body movement/posture displays.” Now observe two-minute intervals for negative “body movement/posture displays.”
5. Each videotape will be viewed a minimum of six times. Additional viewing may be necessary to complete the process.
6. Complete all rating of an episode in one session.
7. Take short stand-up breaks between each viewing. Take longer breaks between episodes.
8. Some behaviors will occur, but will not fit into categories. Ignore these behaviors and avoid trying to make them fit. None of the scales is exhaustive.

Items (Behaviors)	Observation
POSITIVE FACIAL DISPLAYS	
1. Has relaxed facial expression.	Eyes, eyebrows rounded, face appears soft. May not have a smile. Corners of mouth may be slightly downturned.
2. Attend to caregiver’s message.	The subject makes eye contact with caregiver and/or eyes track caregiver. Mark as present even if the subject cannot turn head sufficiently to see the caregiver/object.
3. Make eye contact with object/activity.	Eye contact may be brief or ongoing.
4. Smiles.	The corners of the subject’s mouth turn upward… teeth may or may not be visible. May be accompanied by laughter
NEGATIVE FACIAL DISPLAYS	
5. Has hardened, sad, or worried expression.	Eyes narrowed or sunken. Jaw set, teeth clenched. Stern, scowling, frowning. Vertical creases in forehead. Eyebrows drawn together.
6. Grimaces.	Making a face, i.e. contorting mouth and/or face.
7. Looks into space.	Does not make eye contact with caregiver or object. Blank stare in response to verbal or physical prompting.
8. Keeps eyes closed.	Subject does not open eyes. Exclude if eyes are closed as part of the activity.
POSITIVE VERBAL CONTENT	
1. Verbalizes needs, wants, or feelings about self.	Includes any self-reported feeling toward self (hope, worry, concerns, likes, dislikes).
2. Verbalizes thoughts or feelings about others.	Subject talks about others (family, staff, resident, research team). Does not have to complete the thought.
3. Shares past information about self in response to questions or spontaneously.	Offers information about family, friends, or past experiences. This can be self-initiated or in response to questions.
4. Makes verbal response to activity/	Included in verbal responses is laughing.

conversation without additional verbal or physical prompting.	
5. Calls caregiver by name or "Honey," "Sweetheart," etc.	Subject spontaneously attempts to assign a name to caregiver.
6. Ask questions.	Includes any isolated, nonrepetitive request for information or guidance.
7. Initiates conversation.	Introduces new topic. Continues conversation after lengthy pause. Makes spontaneous comment unrelated to activity. DO NOT INCLUDE QUESTIONS.
NEGATIVE VERBAL CONTENT	
8. Verbalizes specific somatic complaints.	Include pain or discomfort in a particular location.
9. Curses, swears.	The subject uses words such as "hell," "damn," or "shit."
10. Repeated words or phrases.	The subject says the same words/phrases over even though the caregiver has given a response. Excludes stumbling over a word or repeating a word/phrase at the request of the caregiver.
11. Verbalizes repetitive generalized somatic complaints. Such as "hurting all over," "arthritis really acting up," "don't feel good," "don't feel right."	The subject vocalizes a physical complaint, but does not pinpoint a specific location of discomfort.
12. Groans, moans, whimpers, grunts, heavy sighing or similar noise (unrelated to obvious physical condition).	The subject makes a repetitive sound. Exclude a noise made in response to an activity (ouch) or heavy breathing.
13. Verbalizes desire to leave.	The subject verbally states that he/she wants to leave the area or room.
14. Refuses intervention verbally: "No," "Can't do that," "I don't want to."	The subject vocally indicates an unwillingness to participate in/ continue part of an activity. Exclude subject's declining one part of the activity such as drinking juice while participating in a concurrent part, such as eating crackers.
15. Make no vocal response to question or statements.	The subject simply makes no verbal or guttural ("Uh-huh," "Huh-uh") response to the caregiver.

POSITIVE BODY MOVEMENT/POSTURE	
1. Has open posture.	Hands open. Arms not crossed. The fingers of the hand/s are straight or gently curled. Exclude one hand clasping the other hand or wrist.
2. Initiates positive physical contact:	Reaches out, touches, pats, strokes caregiver, or object. Does not include striking out at caregiver or hitting, slapping, etc.
3. Aligns head and/or body toward person/object.	The subject turns head and/or body toward caregiver to participate in activity or attempts to turn even though rigidity prevents complete alignment toward person or object.
4. Participates in activity:	Subject participates with or without verbal or physical prompting. The subject makes the motions desired by caregiver. Motions may not accomplish the desired outcome. The subject works with the caregiver to accomplish task.
5. Move body during interaction, waves hands, nods head, points to object.	
NEGATIVE BODY MOVEMENT/POSTURE	
6. Make repetitive body movements: Rubs body parts. Fidgeting, tapping, wringing hands, swinging legs. Does not include essential tremor or Parkinsonian movements.	The subject repeatedly moves a body part in the same motion. Can include massage.
7. Protects and/or holds a body part	
8. Attempts to leave.	Tries to get out of chair, shower, away from caregiver, etc for the purpose of leaving.
9. Keeps head and/or body nonaligned with person or object: Does not turn toward person/object in response to verbal or physical prompts.	The subject does not attempt to align body toward caregiver or object when interaction or activity occurs. Exclude if subject is involved in an activity that doesn't include turning toward caregiver or object.
10. Pulls back from person/object. Keeps extremities stiff.	The subject pulls back from caregiver/object to stop activity. Stiffness of extremities ins purposeful and not associated with contractures.

11. Has closed posture.	The subject’s arms are crossed in front of his body. Hands are held together.

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