THE EFFECT OF PAIN ON DISRUPTIVE BEHAVIORS IN NURSING HOME RESIDENTS WITH DEMENTIA

By

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To my sons: Dasol and Brian Ahn

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LIST OF ABBREVIATIONS

ADLs	Activities of Daily Living
ASCII	American Standard Code for Information Interchange
CHSRA	Center for Health Systems Research and Analysis
CCI	Charlson Comorbidity Index
CI	Confidence Interval
CMAI	Cohen-Mansfield Agitation Inventory
CMS	Centers for Medicare and Medicaid Service
CNA	Certified Nursing Assistant
DNR	Do Not Resuscitate
DS-DAT	Discomfort Scale for Dementia of the Alzheimer's Type
DV	Dependent Variable
IV	Independent Variable
MDB-ABS	MDS-Aggression Behavior Scale
MDB-CBP	MDS-Challenging Behavior Profile
MDS	Minimum Data Set
MDS-CHESS	MDS-Change in Health, End-stage disease and Signs and Symptoms
MDS-COGS	MDS-Cognition Scale
MDS-CPS	MDS-Cognitive Performance Scale
MDS-DBS	MDS-Discomfort Behavior Scale
MDS-DRS	MDS-Depression Rating Scale
NDB	Need-driven Dementia-compromised Behavior
NH	Nursing Home
NOPPAIN	Non-communicative Patient’s Pain Assessment

OBRA	Omnibus Budget Reconciliation Act
OR	Odds Ratio
PADE	Pain Assessment for the Dementing Elderly
PPQ	Proxy Pain Questionnaire
PWDs	Persons with Dementia
RAI-MH	Resident Assessment Instrument-Mental Health
RAP	Resident Assessment Protocol
RAWS-LTC	Revised Algase wandering scale-Long-Term Care version
RCT	Randomized Controlled Trial
ResDAC	Research Data Assistance Center
RMBPC	Revised Memory and Behavior Problems Checklist
SAGE	Systematic Assessment and Geriatric drug use via Epidemiology
VDS	Verbal Descriptor Scale
VIF	Variance Inflation Factor

Abstract of Dissertation Presented to the Graduate School
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There are 1.5 million nursing home (NH) residents in the U.S. More than half of these residents have dementia. Forty to 80 percent of persons with dementia (PWDs) show disruptive behaviors. The health costs of demented Medicare beneficiaries aged 65 and older are three times higher than other Medicare beneficiaries in the same aged group, and about 30% cost of caring PWDs are directly attributed to the management of disruptive behaviors (Alzheimer's Association, 2011; Beeri, Werner, Davidson, & Noy, 2002). Disruptive behaviors are related to injuries, hospitalization, or death among PWDs (Aud, 2004; Beattie, Song, & LaGore, 2005; Doorn, et al., 2003; Kunik, et al., 2010; Matsuoka, Miyamoto, Ito, & Kurita, 2003; Suh, Yeon, Shah, & Lee, 2005).

The purpose of this study is to examine the effect of pain on disruptive behaviors (wandering behaviors, aggressive behaviors, and agitated behaviors) among NH residents in Florida using Minimum Data Set (MDS) assessment data. The MDS coordinators who complete the MDS assessment document residents' health related characteristics based on reports from facility nursing staff who are familiar with residents, interviews with residents and family members, and a medical chart review.

The unique admission or annual MDS data for non-comatose nursing home residents in Florida during calendar year 2009 (N = 56,577) are used for the analysis. On the average, subjects are 84 years of age (SD = ± 7 years). The majority of subjects are female (67.7%), widowed (53.7%), high school graduates or less (72.4%), Caucasian (78.7%), and mildly or moderately cognitively impaired (54.8%). Subjects have a mean Charlson Comorbidity Index score of 3 (SD = ± 2); take a mean of 11 medications (SD = ± 5); and have a mean MDS-ADL impairment score of 19 (SD = ± 6). The prevalence of pressure ulcer is 18.1%. The prevalence of disruptive behaviors among Florida NH residents with dementia is 9 - 30% (wandering behaviors: 9%; aggressive behaviors: 24%; and agitated behaviors: 30%), and the prevalence of pain is 37%.

Pain is correlated with disruptive behaviors after controlling for the other factors in NH residents with dementia. In order to reduce disruptive behaviors which possibly bring about use of restraints, their underlying causes, such as pain, should be investigated and well managed. However, pain assessment in the cognitively impaired is challenging because they may have difficulties in remembering their pain, interpreting questions and information, or communicating with others (Cohen-Mansfield, 2004; Fisher, et al., 2002; Scherder, et al., 2005). However, the cognitive impaired can demonstrate a number of behaviors indicative of pain (Feldt, 2000; Herr, Coyne, et al., 2006; Warden, Hurley, & Volicer, 2003). Therefore, a comprehensive pain assessment that includes behavioral pain indicators should be developed, and pain should be well controlled to reduce these problematic disruptive behaviors.

CHAPTER 1
BACKGROUND AND SIGNIFICANCE AND THEORETICAL FRAMEWORK

As of 2009, there are 16,000 nursing homes (NHs), 1.7 million beds, and 1.4 million residents in the United States, with approximately 90% of NH residents over 65 years old (Certification and Reporting Database, 2009). In Florida, there are 676 NHs, 81,887 beds, and 71, 657 residents (approximately 5% of U.S. NH residents) (Certification and Reporting Database, 2009). Dementia, a syndrome of several progressive disorders that erases memory and alters a person's usual way of interacting with the world, affects more than half of NH residents (Ballard, O'Brien, et al., 2001; Bula & Wietlisbach, 2009; Magaziner, et al., 2000; N. Wu, Mor, & Roy, 2009). Persons with dementia (PWDs) in NHs have more decline in their activities of daily living (ADLs) than their cognitively intact peers (Armstrong, Glenny, Stolee, & Berg, 2010; Carpenter, Hastie, Morris, Fries, & Ankri, 2006), and are dependent on NH staff for assistance with most of their ADLs (McConnell, Pieper, Sloane, & Branch, 2002).

The most high-cost elders are severely disabled persons who need NH care. The cost of care for PWDs at NHs is three times higher than that of other persons with chronic disease at NHs (Harrow, Tennstedt, & McKinlay, 1995). The majority of PWDs showed disruptive behaviors during the progress of dementia, and it significantly affected the high healthcare cost for PWDs due to injuries, hospitalization, or even death associated with disruptive behaviors.

Disruptive Behaviors in PWDs

The majority of PWDs display disruptive behaviors, reaching between 60% to 90% in some groups (Ballard, O'Brien, et al., 2001; Brodaty, et al., 2001; Matsuoka, et al., 2003; Sloane, et al., 2007; Steinberg, et al., 2003; Testad, Aasland, & Aarsland, 2007; Zuidema, Derksen, Verhey, & Koopmans, 2007).

Disruptive behaviors, also known as “problematic behaviors”, “disturbing behaviors,” or “challenging behaviors”, refer to inappropriate, repetitive, or dangerous behaviors that are disruptive to the living and working environment in the NH (Allen-Burge, Stevens, & Burgio, 1999; Kovach, Noonan, Schlidt, Reynolds, & Wells, 2006; Pieper, et al., 2011; Whall, Gillis, Yankou, Booth, & Beel-Bates, 1992). Disruptive behaviors that accompany the cognitive and functional decline in dementia syndromes are common, distressing to PWDs themselves, and are troublesome to NH staff and other residents (Leonard, Tinetti, Allore, & Drickamer, 2006; Talerico, Evans, & Strumpf, 2002; H. Z. Wu, Low, Xiao, & Brodaty, 2009). Disruptive behaviors cause hospitalization, injuries to PWDs and/or other residents, NH staff burnout, damage to property, and contribute to the high cost of long-term care.

Among many disruptive behaviors, three behaviors are most prominent in the current literature: wandering behaviors, aggressive behaviors, and agitated behaviors (Aalten, et al., 2006; Aud, 2004). Wandering is defined 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, elopement attempts or getting lost unless accompanied” (Algase, Yao, Beel-Bates, & Song, 2007). Wandering occurs in approximately 60% of PWDs (Alzheimer’s Association, 2007; Matsuoka, et al., 2003; Sink, Covinsky, Newcomer, & Yaffe, 2004). Aggression is defined as an overt act, involving the delivery of noxious stimuli to (but not necessarily aimed at) another organism, object or self, which is clearly not accidental, and includes verbally or physically abusive and threatening behaviors (Nösman, Bucht, Eriksson, & Sandman, 1993; Patel & Hope, 1992; Ryden, 1988). Aggression occurs in about 42% to 82% of NH residents with cognitive impairments (Brodaty, et al., 2001; Chen, Borson, & Scanlan, 2000; Kunik, et al., 2007;

Schreiner, 2001). Agitation is defined as an unpleasant state of excitement experienced by the persons with dementia having excessive, inappropriate, repetitive, non-specific, and observable nature (Kong, 2005). Agitation occurs in about 40% to 60% of NH residents with dementia (Ballard, Margallo-Lana, et al., 2001; Margallo-Lana, et al., 2001; Suh, 2004; Wood, et al., 2000).

Other disruptive behaviors discussed in the literature include repetitive vocalization, sexual disinhibition, delusions, and hallucinations. These behaviors occur less frequently (ranging from 9% to 36%) than wandering, aggression, and agitation (Palese, Menegazzo, Baulino, Pistrino, & Papparotto, 2009; Sink, Holden, & Yaffe, 2005; Volicer, Bass, & Luther, 2007).

Pain in PWDs

Pain is common among NH residents, affecting 50% to 80% of NH residents (Achterberg, et al., 2010; Black, et al., 2006; Horgas & Dunn, 2001; Jones, et al., 2006; Smalbrugge, Jongenelis, Pot, Beekman, & Eefsting, 2007; D. Weiner, Peterson, & Keefe, 1999; Zanocchi, et al., 2008; Zwakhalen, Koopmans, Geels, Berger, & Hamers, 2009). There is no empirical evidence that PWDs experience less pain, but the prevalence of pain among PWDs is lower than their cognitively intact counterparts (American Geriatric Society, 2002). Detecting pain in PWDs is challenging due to cognitive and communicative impairments (Horgas, Elliott, & Marsiske, 2009; Kunz, Mylius, Scharmann, Schepelman, & Lautenbacher, 2009; McAuliffe, Nay, O'Donnell, & Fetherstonhaugh, 2009). Pain self-report, the gold standard assessment in cognitively intact persons, is questionable in PWDs because dementia impairs their ability to remember, interpret, and respond to pain. Thus, pain is often under-reported in PWD, even when there is a probable cause for pain (Horgas, et al., 2009; Horgas & Tsai, 1998). These PWDs' impairments may make it hard to appropriately articulate or convey their pain intensity (Horgas & Miller, 2008; Snow, et al., 2009; Tait & Chibnall, 2008).

Consequently, NH residents with dementia are less likely to have pain medication, and, when administered, often receive lower dosages of pain medications than do other older adults (Chibnall & Tait, 2001; Horgas & Tsai, 1998; Morrison & Siu, 2000; Shega, et al., 2007). Sengupta and colleagues (2010) reported that 56% of non-Caucasian NH residents with dementia lacked relevant pain treatment compared to 44% of non-Caucasian cognitively intact NH residents using data from the 2004 National Nursing Home Survey.

The Relationship between Pain and Disruptive Behaviors

Some recent studies suggest that pain may contribute to disruptive behaviors in PWDs. Dementia impairs cognitive and communicative abilities. Thus, PWDs may express pain through disruptive behaviors because they cannot properly verbalize their pain experience (Braun & Kunik, 2004; Desai & Grossberg, 2001; Scherder, et al., 2009; Shega, et al., 2007; Snow, et al., 2009). Cipher and Clifford (2004) reported pain effected disruptive behaviors among 234 residents living in eight long-term care facilities in Texas.

PWDs gradually lose the ability to think, reason, remember, learn, speak, understand, and process information so that they are less likely to express pain in typical ways even when severe pain is present (Cunningham, McClean, & Kelly, 2010; Horgas & Elliott, 2004; Horgas, et al., 2009; Horgas & Miller, 2008; Schmidt, et al., 2010). Disruptive behaviors may be one of the ways that PWDs express pain. Does pain severity contribute to disruptive behaviors in NH residents with dementia? This question serves as the foundation for this study.

Significance of the Proposed Study

Disruptive behaviors are hard to control (Snowden, Sato, & Roy-Byrne, 2003), so their prevention is preferable. The use of physical restraints in NHs has declined since the implementation of the Omnibus Budget Reconciliation Act of 1987 (OBRA ’87) which established regulatory guidelines for the use of chemical and physical restraints (Siegler, et al., 1997); however, restraints are still often used to manage disruptive behaviors in PWDs (Bourbonniere, Strumpf, Evans, & Maislin, 2003; Cotter, 2005; Evans & Cotter, 2008; Gallinagha, 2002; Hamers, Gulpers, & Strik, 2004; Mace & Rabins, 2006). Provisions of the Nursing Home Reform Act (1987), which were included in OBRA '87, stipulated that "restraints were to be imposed only to ensure the physical safety of the resident or that of other residents and only on the written order of a physician… orders for restraints were required to be specific with regard to the duration and circumstances for their use" (Guttman, Altman, & Karlan, 1999).

These restraints have been shown to lead to functional disabilities, mobility problems, cognitive disturbances, multiple falls, incontinence, chronic constipation, pressure ulcers, loss of bone mass and muscle tone, skin abrasions, contractures, cardiac stress, lower extremity edema, disorganized behavior, sensory deprivation, and increased confusion and agitation (Flannery, 2003; Huabin, Lin, & Castle, 2011; W. W. Wang & Moyle, 2005). With person-centered care, there is an increased concern about the loss of dignity, loss of autonomy, and suppression of overall wellbeing that is imposed by the use of physical or chemical restraints (Touhy, 2004). The use of restraints to limit the freedom of a PWD poses a major risk to personal dignity, in addition to the potential for physical harm.

Disruptive behaviors can be interpreted as meaningful bodily expressions that describe something about the person's needs or wishes that require addressing, such as pain. The use of restraints as a disruptive behavior management mechanism for PWDs violates the respect for autonomy. The better approach to managing disruptive behaviors is to control their possible cause, such as pain, rather than using restraints to control NH residents and thus reduce these behaviors. This study may reveal that pain plays an important factor in disruptive behaviors. If the pain is associated with disruptive behaviors, it would suggest that pain management might prevent or reduce disruptive behaviors of PWDs.

Theoretical Framework

A theory is an organized, coherent, and systematic articulation of a set of statements related to significant questions in a discipline that are communicated in a meaningful whole. It is a symbolic depiction of aspects of reality that are discovered or invented for describing, explaining, predicting, or prescribing responses, events, situations, conditions, or relationships (Meleis, 2007). A theory guides the rationale for research, the selection of independent and dependent variables by explaining the relationships between them, the hypotheses which are deduced from the theory’s assumptions or propositions, the research design which uses sound and relevant instruments and suitable study participants, and selection of statistical analyses and interpretation of the results. Without a theoretical framework a researcher will be unable to understand the implications of the findings, and observations will be ended in isolated information.

The Original Theoretical Model

The need-driven dementia-compromised behavior (NDB) model (Algase, Yao, et al., 2007) is adapted to explain disruptive behaviors in relation to pain (Figure 1-1). The NDB model is the prevailing theory that explains disruptive behaviors of PWDs. The NDB model hypothesizes that there are two main constructs that predict disruptive behaviors: background factors and proximal factors. Background factors, consisting of neurocognitive factors, general health, personal characteristics, sociodemographics, are hypothesized to identify PWDs who are likely to show behavioral symptoms under certain conditions. Proximal factors, consisting of physiological and psychological needs and social/physical environment, are explained to represent the conditions under which disruptive behaviors occur. The NDB model posits that pain has a direct effect on disruptive behaviors and that pain mediates the relationship between background factors (e.g., neurocognitive factors, general health, personal characteristics, and sociodemographics) and disruptive behaviors.

Major propositions of the NDB model are: (1) Background factors constitute relatively stable, slowly changing features of PWDs; (2) Proximal factors are more dynamic characteristics of PWDs and of the environment; (3) Proximal factors are perceived in the context of existing background factors; (4) Both proximal and background factors directly affect the NDBs; and (5) Both background and proximal factors interact or combine in some sequence to produce NDBs (Algase, Yao, et al., 2007).

The Adapted Theoretical Model

The adapted theoretical model is shown in Figure 1-2. The investigator of this study adapted the NDB model to study the effect of the pain on disruptive behaviors of NH residents with dementia. The adapted model will serve as the theoretical framework for this study. To study the effect of pain on disruptive behaviors, the physiological need states among proximal factors will be investigated. All background factors except personal characteristics (e.g., personality and stress response) are included because none of the published studies reported the relationship between personal characteristics, as defined in this theory, and pain. Three major disruptive behaviors are chosen for this study: wandering behaviors, agitated behaviors, and aggressive behaviors. Table 1-1 shows each construct, the theoretical definition, and empirical indications of measurement.

Statement of Problem and Specific Aims

The purpose of this study is to explore the relationship between pain severity and the frequency of disruptive behaviors in NH residents with dementia (e.g., wandering behaviors, aggressive behaviors, and agitated behaviors). Such information would be of substantial benefit in understanding the effect of pain severity on disruptive behaviors, and may identify potential new intervention approaches for managing these behaviors.

The specific aims and hypotheses are described below:

First aim. To describe the prevalence of disruptive behaviors in NH residents with dementia. 1A) To describe the prevalence of wandering behaviors as measured by MDS-wandering frequency in NH residents with dementia. 1B) To describe the prevalence of aggressive behaviors as measured by MDS-Aggression Behavior Scale (MDS-ABS) in NH residents with dementia. 1C) To describe the prevalence of agitated behaviors as measured by MDS-Challenging Behavior Profile (MDS-CBP) agitation subscale in NH residents with dementia.

Second aim. To investigate the effect of pain severity on the frequency of disruptive behaviors in NH residents with dementia, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence). 2A) To investigate the effect of pain severity on the frequency of wandering behaviors as measured by MDS-wandering frequency in NH residents with dementia, after controlling for the other background/proximal factors. 2B) To investigate the effect of pain severity on the frequency of aggressive behaviors as measured by MDS-Aggression Behavior Scale (MDS-ABS) in NH residents with dementia, after controlling for the other background/proximal factors. 2C) To investigate the effect of pain severity on the frequency of agitated behaviors as measured by MDS-challenging behavior profile (MDS-CBP) agitation subscale in NH residents with dementia, after controlling for the other background/proximal factors.

Hypothesis for the second aim. Among NH residents with dementia, pain severity will be significantly associated with increased frequency of disruptive behaviors, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence). 2A) Among NH residents with dementia, pain severity will be significantly associated with increased frequency of wandering behaviors as measured by MDS-wandering frequency, after controlling for the other background/proximal factors. 2B) Among NH residents with dementia, pain severity will be significantly associated with increased frequency of aggressive behaviors as measured by MDS-ABS, after controlling for the other background/proximal factors. 2C) Among NH residents with dementia, pain severity will be significantly associated with increased frequency of agitated behaviors as measured by MDS-CBP agitation subscale, after controlling for the other background/proximal factors.

Third aim. To evaluate whether pain severity mediates the effect of background factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, and ethnicity) on the frequency of disruptive behaviors in NH residents with dementia. 3A) To evaluate whether pain severity mediates the effect of background factors on the frequency of wandering behaviors as measured by MDS-wandering frequency in NH residents with dementia. 3B) To evaluate whether pain severity mediates the effect of background factors on the frequency of aggressive behaviors as measured by MDS-Aggression Behavior Scale (MDS-ABS) in NH residents with dementia. 3C) To evaluate whether pain severity mediates the effect of background factors on the frequency of agitated behaviors as measured by MDS-challenging behavior profile (MDS-CBP) agitation subscale in NH residents with dementia.

Hypothesis for the third aim. Among NH residents with dementia, pain severity will mediate the effect of background factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, and ethnicity) on the frequency of disruptive behaviors. 3A) Among NH residents with dementia, pain severity will mediate the effect of background factor on the frequency of wandering behaviors as measured by MDS-wandering frequency in NH residents with dementia. 3B) Among NH residents with dementia, pain severity will mediate the effect of background factors on the frequency of aggressive behaviors as measured by MDS-Aggression Behavior Scale (MDS-ABS) in NH residents with dementia. 3C) Among NH residents with dementia, pain severity will mediate the effect of background factors on the frequency of agitated behaviors as measured by MDS-challenging behavior profile (MDS-CBP) agitation subscale.

Fourth aim. To investigate those three aims in the unrestrained residents. 4A) To describe the prevalence of disruptive behaviors in the unrestrained residents. 4B) To investigate the effect of pain severity on the frequency of disruptive behaviors in the unrestrained residents, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence). 4C) To evaluate whether pain severity mediates the effect of background factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, and ethnicity) on the frequency of disruptive behaviors in the unrestrained residents.

Hypothesis for the fourth aim. 4A) Among the unrestrained residents, disruptive behaviors will be more prevalent. 4B) Among the unrestrained residents, pain severity will be significantly associated with increased frequency of disruptive behaviors, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence). 4C) Among the unstrained residents, pain severity will mediate the effect of background factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, and ethnicity) on the frequency of disruptive behaviors.

Summary

Pain and disruptive behaviors are common and problematic in NH residents with dementia (Achterberg, et al., 2010; Leonard, et al., 2006; Whall, et al., 1992). Pain assessment in PWDs is challenging because of their cognitive and communicative impairments, and pain should be measured by the comprehensive approach including behavioral pain indicators (Horgas, et al., 2009; McAuliffe, et al., 2009). Pain in persons with cognitive impairments can be expressed via disruptive behaviors, such as wandering, aggression, and agitation. To reveal the relationship between pain and disruptive behaviors, the NDB model (Algase, et al., 1996; Algase, Yao, et al., 2007) will be adapted and used as the theoretical framework for this study. A theoretical framework is necessary for a study to contribute to science (Meleis, 2007).

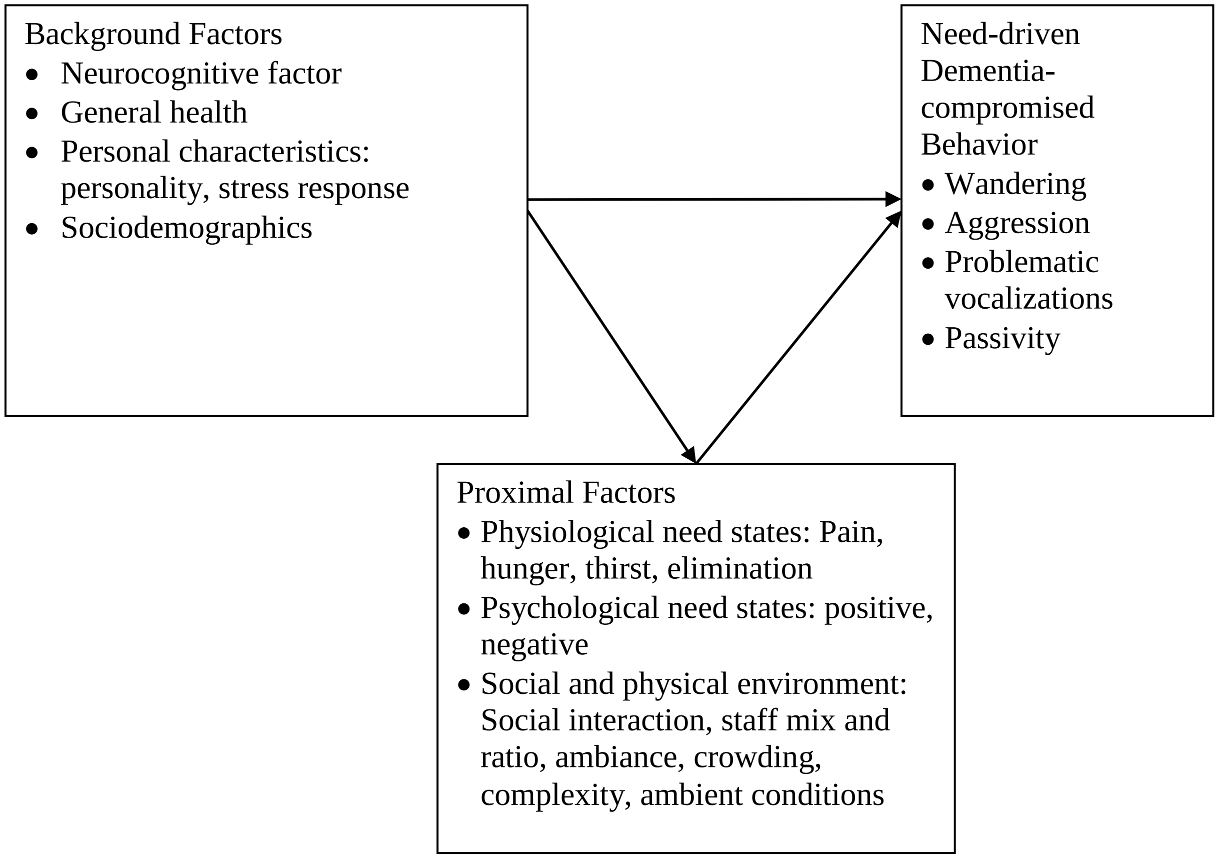

Figure 1-1. The Need-driven Dementia-compromised Behavior (NDB) model

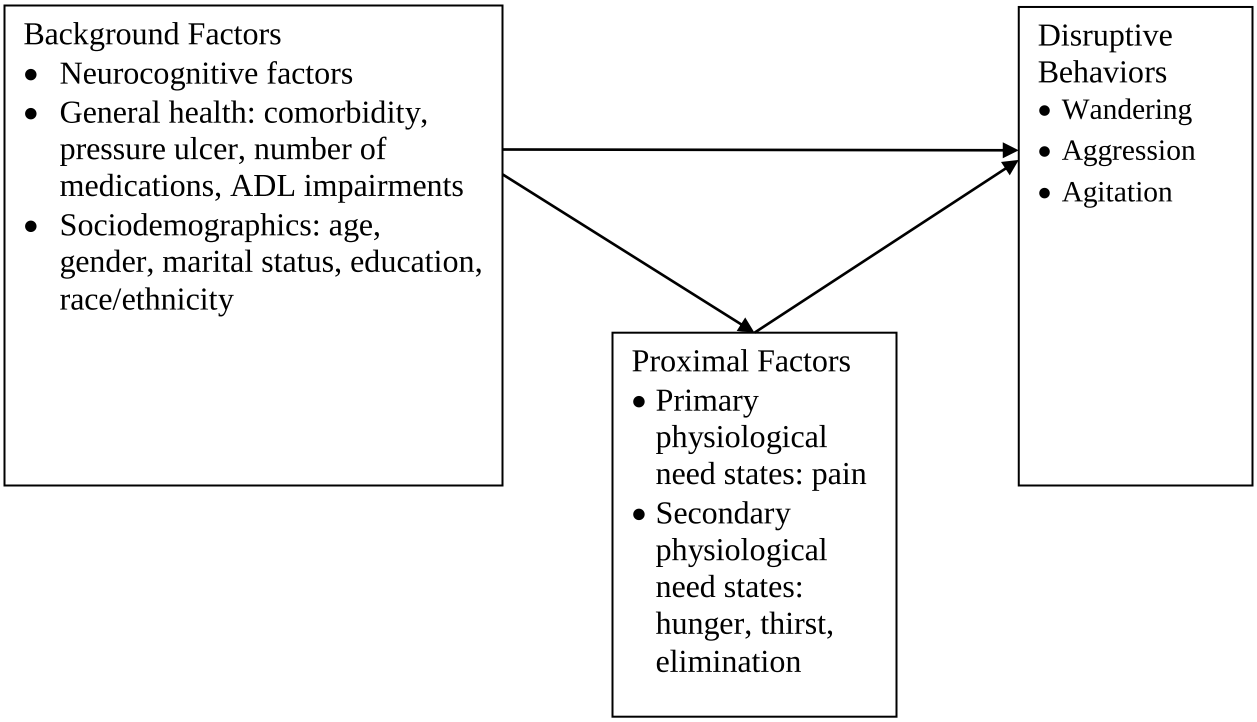

Figure 1-2. The adapted theoretical model for the current study

Table 1-1. Conceptual, theoretical, and empirical indications for this study

Conceptual	Theoretical	Empirical Indications
Pain	A distressing sensation in a particular part of the body	MDS-Pain severity scale
Hunger	A strong desire or need for food	Complaints of Hunger (MDS item # K4B)
Thirst	A sensation of dryness in the mouth and throat related to a need or desire to drink	Dehydration (MDS item # J1C)
Elimination	Bodily discharges including urine and feces	Bowel continence (MDS item # H1A), and Bladder continence (MDS item # H1B)
Neurocognitive factor	The mental capacity of retaining and reviving facts, events, and impression, or of recalling or recognizing previous experiences	MDS-Cognitive Performance Scale (MDS-CPS)
General health	Overall conditions of a person's body (e.g., comorbidity, pressure ulcer, number of medications, activities of daily living)	Charlson Comorbidity Index, pressure ulcer (MDS item # M2), number of medications (MDS item # O1), and MDS ADL-Long Form scale (MDS item # G1)
Sociodemographics	sociological and demographical measure relative to others	Age (MDS item # AA3), gender (MDS item # AA2), marital status (MDS item # A5), education (MDS item # AB7), and race/ethnicity (MDS item # AA4)
Wandering behaviors	A syndrome of dementia-related locomotion behavior having a frequent, repetitive, temporally-disordered and/or spatially-disoriented nature	Wandering frequency (MDS item # E4AA)
Aggressive behaviors	Physical or verbal harming others that is manifested in hitting, kicking, and screaming	MDS-Aggression Behavior Scale (MDS-ABS)
Agitated behaviors	An unpleasant state of excitement experienced by the persons with dementia having excessive, inappropriate, and repetitive nature	MDS-Challenging Behavior Profile (MDS-CBP) agitation subscale

MDS: Minimum Data Set

CHAPTER 2
REVIEW OF LITERATURE

Nursing Homes

Nursing Homes in the United States

As of 2009, there are 16,000 NHs, with 1.7 million beds, and 1.4 million residents (82% occupancy rate) in the U.S. (Certification and Reporting Database, 2009). Approximately 99 % of these NHs are certified by Medicaid or Medicare, and 99% of NH residents reside in Medicaid or Medicare certified NHs. Approximately 62% of NHs are owned by proprietary organizations, 43% have 100 − 199 beds, and 68% are located in metropolitan areas. The characteristics of NHs in the U.S. are summarized in the Table 2-1.

Nursing Homes in Florida

As of 2009, there are 676 NHs, 81,887 beds, and 71, 657 residents (87.5% occupancy rate) in Florida (Certification and Reporting Database, 2009). Approximately 71% of the NHs are owned by proprietary organizations, 76 % of the NHs are certified by Medicaid or Medicare (Shaping Long Term Care in America Project, 2007).

The Nursing Home Minimum Data Set (MDS)

The MDS assessment data is mandatory in all United States NHs certified to participate in Medicare and Medicaid, and contains standardized physical, psychological and psycho-social assessment data of NH residents. The MDS data includes a 284-item instrument which can be converted to categorical or continuous measures that generally meet the psychometric criteria of reliability and validity (Sgadari, et al., 1997; Shin & Scherer, 2009). The MDS data is a structured and comprehensive questionnaire to collect data on NH residents' medical and health status (Morris, et al., 1990). The major sections and items in the MDS are described in the Table 2-2.

A full MDS assessment is completed on admission for every patient and annually thereafter. A shortened assessment is achieved on a quarterly basis. A trained clinical professional, typically a licensed registered nurse, completes the MDS assessment using data from interviews with facility nursing staff, residents and family members, and a medical chart review. The MDS was intended for a multidimensional view of the patient's functional capacities, monitoring the quality of care provided to NH residents, and research purposes (Ouslander, 1994).

Historical Context

The first MDS was developed in the U.S. in 1988 in response to the United States Congress' Omnibus Budget Reconciliation Act of 1987 (OBRA '87), which mandates resident assessment to formulate a resident's care plan and improve NH quality of care (Hawes, et al., 1997). The MDS 1.0 was tested and modified through consultation with and suggestions from researchers and government regulators. The MDS 1.0 was nationally implemented in 1991, and the revised MDS 2.0 was nationally implemented in 1995. The MDS 2.0 had expanded stipulated standard assessment procedures for resource utilization and quality indicators. The newer version MDS 3.0 was nationally implemented in October 2010. Compared to previous versions, the MDS 3.0 mandated the resident interview on mental status, mood, pain, and health related quality of life and wider use of standardized assessment procedures, in an effort to increase measurement reliability and validity. The Cronbach's alpha for mental status, mood, pain, behavior, and customary routines is increased, ranging from .92 to .97 (Rahman & Applebaum, in press). Also, the MDS assessment time was reduced by 45% to an average of one hour by expanding standard assessment procedures to mental status and health related quality of life (MDS 2.0 did not stipulate the standard assessment procedure of those areas).

The Use of the MDS

The clinical and research use of MDS assessment data are described below.

Clinical use

The MDS assessment data are used in screening functional status to identify potential problems and strengths of residents, and in monitoring quality of care. So far, MDS assessment improved quality of care in NHs by reducing restraints, decreasing dehydration, and increasing physical and cognitive function (Shin & Scherer, 2009). The standardized MDS assessment data are also used in comparing one NH with another, and in monitoring the quality of care in NHs by providing the data from which measures of NH quality indicators can be created at minimal cost. All MDS data are conveyed through state public health agencies to a national database maintained by the Centers for Medicare and Medicaid Services (CMS). All NHs certified by CMS are required to submit MDS data electronically to CMS on a quarterly basis.

Research use

The MDS assessment data, standardized data on residents' status based on routine and continuous observations by NH nursing staff, are widely used in behavioral studies of NHs because it provides comprehensive information on all United States NH residents. It is a comprehensive data of over 1.5 million older adults who live in CMS certified NHs. The MDS has also shown acceptable reliability and validity (Frederiksen, Tariot, & De Jonghe, 1996; Hawes, et al., 1995; Mor, 2004; Morris, et al., 1990; Sgadari, et al., 1997; Shin & Scherer, 2009; Snowden, et al., 1999; Snowden, et al., 2003; Stineman & Maislin, 2000; Y. Wang, Byers, & Velozo, 2008; Zhang, Paek, & Wan, 2009).

Quality Indicators Based on the MDS

There are quality indicators based on the MDS, developed by researchers at the Center for Health Systems Research and Analysis (CHSRA) at the University of Wisconsin-Madison, which indicate poor care practices or outcomes. Twenty-four quality indicators covering 11 health care domains were reviewed by national clinical panels involved in NH care and finalized after testing clinical validity and statistical robustness (Hutchinson, et al., 2010) including:

- Accidents: incidence of new fractures and prevalence of falls
- Behavioral and emotional patterns: prevalence of behavioral symptoms affecting others, prevalence of symptoms of depression, and prevalence of symptoms of depression without antidepressant therapy
- Clinical management: use of nine or more different medications
- Cognitive patterns: incidence of cognitive impairment
- Elimination and continence: prevalence of bladder/bowel incontinence, prevalence of occasional bladder/bowel incontinence without a toileting plan, and prevalence of indwelling catheters, prevalence of fecal impaction
- Infection control: prevalence of urinary tract infections
- Nutrition and eating: prevalence of weight loss, prevalence of tube feeding, prevalence of dehydration
- Physical functioning: prevalence of bedfast residents, incidence of decline in late-loss ADLs, incidence of decline in range of motion
- Psychotropic drug use: prevalence of antipsychotic use in the absence of psychotic and related conditions, prevalence of anti-anxiety/hypnotic use, prevalence of hypnotic use more than two times in last week
- Quality of life: prevalence of daily physical restraints, prevalence of little or no activity
- Skin care: prevalence of stage 1 – 4 pressure ulcers

There is a report that qualify indicators are not valid measures for nursing quality in NHs (Hutchinson, et al., 2010), but these quality indicators are used to assist healthcare providers in identifying potential problem areas that would benefit from quality improvement programs and evaluating the effect of these programs, to help guide policy makers, and to serve as a source of consumer information (Centers for Medicare & Medicaid Services, 2010). Many NHs undertake quality improvement programs based on the quality indicators derived from MDS assessment data (Rantz, et al., 2000). NH administrators and care providers identify and analyze the extent and impact of quality problems, inform the developers of quality improvement initiatives, track responses to quality initiatives, and benchmark their facility's performance with national averages using quality indicators (Grando, Rantz, & Maas, 2007; Hutchinson, et al., 2010). The regulatory state inspectors focus on identified quality problems based on quality indicator reports of a NH's performance (Mor, et al., 2003). Quality indicators are used as a starting point for the inspection process of NHs. Consumers or their families can use the MDS public quality data to help select a NH (Edgman-Levitan & Cleary, 1996). NHs can be compared using numerous quality indicators based on MDS assessment data.

Scales Based on the MDS

There are many MDS-based scales that have been developed for research purposes:

- MDS-Pain severity scale (Fries, Simon, Morris, Flodstrom, & Bookstein, 2001)
- MDS-Depression Rating Scale (MDS-DRS) (Burrows, Morris, & Simon, 2000)
- MDS-Aggression Behavior Scale (MDS-ABS) (Perlman & Hirdes, 2008)
- MDS-Challenging Behavior Profile (MDS-CBP) (Gerritsen, et al., 2008)
- MDS-Discomfort Behavior Scale (MDS-DBS) (Stevenson, Brown, Dahl, Ward, & Brown, 2006)
- MDS-Cognitive Performance Scale (MDS-CPS) (Bula & Wietlisbach, 2009; Hartmaier, Sloane, Guess, & Koch, 1994; Hartmaier, et al., 1995; McConnell, et al., 2002; Morris, et al., 1994; Stevenson, et al., 2006)
- MDS-Cognition scale (MDS-COGS) (Hartmaier, et al., 1994; Zimmerman, et al., 2007)
- MDS-Cognition (Casten, Lawton, Parmelee, & Kleban, 1998; Hawes, et al., 1995; Lawton, et al., 1998; Morris, et al., 1990; Sgadari, et al., 1997)
- MDS-index of social engagement (Achterberg, et al., 2003; Hawes, et al., 1995; Sgadari, et al., 1997)
- MDS-Activities of Daily Living scale (MDS-ADL) (Frederiksen, et al., 1996; Williams, Li, Fries, & Warren, 1997)

- Resident Assessment Instrument-Mental Health (RAI-MH) (Hirdes, et al., 2002), and
- MDS-Change in Health, End-stage disease and Signs and Symptoms (MDS-CHESS) (Hirdes, Frijters, & Teare, 2003).

These scales have been shown to have moderate to high validity and reliability coefficients and widely used in behavioral studies for NH residents.

Accuracy of the MDS

In general, the MDS data have been reported to have acceptable reliability and validity coefficients. Rahman and Applebaum (in press) reported that inter-rater reliability coefficient ranges from 0.92 to 0.97 for MDS-mental status, mood, pain, behavioral symptoms, and ADLs, and 0.75 to 0.89 for delirium. Wang and colleagues (2008) reported that Pearson reliability coefficient of MDS-physical functioning items was 0.89 and that of MDS-cognition items was 0.68 via Rasch analysis using MDS data collected by the Department of Veteran Affairs Austin Automation Center. Zhang and colleagues (2009) reported that the majority of clinical measures of MDS data exhibit good reliability coefficients. Parmelee and colleagues (2009) reported more than 75% of respondents rated MDS assessment data as accurate or very accurate, and only 2% of respondents rated MDS assessment data as inaccurate or very inaccurate using data from 289 directors of nursing, medical directors, MDS coordinators, nurse managers and other clinical management staff at 97 Veterans Affairs Medical Center nursing home care units nationwide. A detailed report for MDS items will be presented in a later section.

There have been some concerns that the MDS may underreport or over-report some symptoms. Shin and Scherer (2009) stated that vision, health conditions, pain, and falls were underreported in the MDS data, and intravenous medication, intake and output, and special therapies are over-reported in MDS data. Bharucha and colleagues (2008) reported that MDS significantly underestimated verbally abusive symptoms ($p < .002$), physically abusive symptoms (*p* = .008), and socially inappropriate behaviors (*p* = .016) compared with corresponding items from the Ryden Aggression Scale and the Cohen-Mansfield Agitation Inventory (CMAI) for 15 NH residents with severe dementia. Lum and colleagues (2005) reported that the agreement on ADL assessments between MDS and interview data was low to moderate (Kappa = .25 to .52) using 3,385 ADL assessment data points from MDS data. They stated that the MDS assessment data reported fewer ADL difficulties than interview data obtained from staff proxies, and more ADL difficulties than interview data derived from residents. They tested the possible sources of bias using multinomial logit regression, and found that a large portion of the discrepancy in the MDS and interview assessments was accounted for not by the biases, but by the confusion of the categorization of ADL items. Chu and colleagues (2004), using data from 895 residents in 33 community-based NHs, reported that 63 % of residents who reported daily pain or activity-limiting pain on interview did not have daily or moderate to severe pain recorded on the MDS data. Cohen-Mansfield (2004), using data from 80 NH residents, reported that MDS pain ratings and the geriatricians' pain ratings were significantly correlated for those with mild or moderate cognitive impairment but not for those with severe impairment. Fisher and colleagues (2002) found that the MDS-pain assessment and the Proxy Pain Questionnaire (PPQ) are not well correlated (pain frequency: $r = .19$, $p = .18$; pain intensity: $r=.22$, $p = .11$). Horgas and Margrett (2001) found that MDS assessments on cognition were significantly different from the Revised Memory and Behavior Problems Checklist (RMBPC) ($t = -7.3$, $p < 0.001$) using data from 135 NH residents at one NH. NH residents with dementia had significantly higher scores on the CPS than memory-related behavior subscale of the RMBPC. Bates-Jensen and colleagues (2005) reported that there was poor agreement between MDS bed-mobility ratings and the research-staff performance assessments (kappa range, $\kappa = 0.007$, $p = .918$ to $\kappa = 0.484$, $p < .001$), and MDS over-reported resident dependency in bed mobility using data from197 long-stay residents from 26 California NHs.

Random errors and bias by the MDS coordinators who completed the measure, not the characteristics of the MDS indicators, seem to be mostly responsible for the inaccuracy of the MDS assessment data (Shin & Scherer, 2009). Hendrix and colleagues (2003) reported that nurse administrators, who may have been trained to complete the MDS but have limited contact with the residents, may have completed the MDS so that MDS depression indicators do not reveal manifestations of depression in NH residents. They also raised concerns that the MDS completed by nurses who do not directly take care of residents may result in MDS data that do not reflect residents' real health status. Anderson and colleagues (2003) reported that nursing staff in many NH facilities do not receive enough training on how to evaluate residents for distressed mood or behavioral symptoms on the MDS. McCurren (2002) raised concerns that MDS coordinators were not knowledgeable about dealing with the psychological and behavioral problems or were overburdened in managing residents' health problems so that MDS assessment data may not accurately reflect those symptoms.

Psychometric Evidence of the MDS Items Used in This Study

Psychometric studies on MDS 2.0 regarding the key elements of this research (e.g., pain, cognition, and disruptive behaviors) are summarized in the Table 2-3. The detailed reliability and validity coefficients for this study items will be described in the Chapter 3.

Most studies on validity of the MDS are reported using criterion validity, which is measured by the correlation between one instrument with other measures already held to be valid and taken as representative of the construct. Criterion validity coefficient ranges from zero to one, with higher values indicating higher criterion validity (Polit & Beck, 2004). The criterion validity measured by comparing the MDS with validated research instruments of pain, cognition, ADLs, and disruptive behaviors are acceptable, ranging from 0.41 to 0.77.

The studies on reliability of the MDS used internal consistency reliability, inter-rater reliability, and test-retest reliability. Internal consistency reliability refers to the degree to which the subparts of an instrument are all measuring the same attribute or dimension (Polit & Beck, 2004). The most widely used method for evaluating internal consistency reliability is Cronbach's alpha coefficient. Cronbach's alpha ranges from zero to one, with higher values indicating higher internal consistency. Commonly, a Cronbach's alpha of 0.6-0.7 indicates acceptable reliability, and 0.8 or higher indicates good reliability (Polit, 2010). Inter-rater reliability refers to the degree to which two raters assign the same ratings for an attribute being measured after independently recording data according to the instrument's manual. Test-retest reliability refers to assessment of the stability of an instrument by administering the same measures to a sample on two occasions, and comparing and correlating the scores obtained on repeated administrations. The reliability of the MDS of pain, cognition, ADLs, and disruptive behaviors are acceptable, ranging from 0.61 to 0.97 (Casten, et al., 1998; Cohen-Mansfield, Taylor, McConnell, & Horton, 1999; Fisher, et al., 2002; Fries, et al., 2001; Gerritsen, et al., 2008; Hawes, et al., 1995; Lawton, et al., 1998; Perlman & Hirdes, 2008; Sgadari, et al., 1997).

Summary

There are some concerns with the underreporting of symptoms of residents, mainly due to the variations in how MDS coordinators complete the tool. The MDS assessment data, however, has a number of advantages that counterbalance these limitations. First, researchers have access to large samples representing populations at state and national levels. Second, MDS assessment data have acceptable reliability and validity for a study of pain, cognition, and disruptive behaviors. Considering the difficulty of consistent caregiving of PWDs in NHs and their cognitive and communicative inabilities, MDS assessment data based on regular and continuous observation by NH staff is considered a reliable instrument. Third, the use of the MDS for secondary analysis is efficient and economical, and can decrease time and money for research questions that might otherwise be tedious and expensive to investigate. Fourth, the longitudinal nature of MDS assessment data allows for the examination of trends over time. The longitudinal nature of MDS assessment data, collected every three months or more often during a one-year period, lends strength to the data's ability to describe change over time, lagged relationships or longitudinal relationships, and facilitates the use of more powerful statistical analysis techniques to describe both within- and between-person changes. Thus, this proposed study, examining cross-sectional relationships between pain and disruptive behaviors will be an important foundation for future research examining relationships over time.

Characteristics of NH Residents

Demographics of NH residents

Approximately 90% of NH residents in the U.S. are over 65 years old, 70% are female, 85% are Caucasian, 60% reside in for-profit NH facilities, 70% reside in 100+ bed facilities, 80% reside in metropolitan areas, about half of them are widowed, and the most common residence before NH admission is an acute care hospital (35%) (National Center for Health Statistics, 2006). Thirty-five out of 1,000 persons whose age is 65 years or more reside in NHs, and 139 out of 1,000 persons whose age is 85 years or over reside in NHs (National Center for Health Statistics, 2009).

Health Characteristics of NH Residents

Health characteristics of NH residents are described using Florida NH residents. The followings are the health characteristics in Florida NH residents: 41% have Do Not Resuscitate (DNR) orders, 44% have no or mild cognitive impairment (MDS-CPS score=0-2), 38% have moderate cognitive impairment (MDS-CPS score=3-4), 18% have severe cognitive impairment (MDS-CPS score=5-6), 4% are bedfast, 8% walk independently, 54% have bowel incontinence, 59% have bladder incontinence, 18% have fall accidents, 52% take antidepressants, and 25% take antipsychotics (Shaping Long Term Care in America Project, 2007).

NH Residents with Dementia

Dementia, caused by various diseases and conditions that result in damaged brain cells or neurons, affects more than one-half of NH residents (Ballard, O'Brien, et al., 2001; Bula & Wietlisbach, 2009; Magaziner, et al., 2000; Margallo-Lana, et al., 2001; N. Wu, et al., 2009). Commonly, PWDs need help with many activities of daily living, such as bathing, dressing, using the bathroom, or eating, so caregivers' resources are exhausted and PWDs eventually move into a NH where professional care is available 24 hours a day, seven days a week (Gaugler, et al., 2010; Kopetz, et al., 2000). In 2004, Medicare beneficiaries with dementia were eight times more likely to have a Medicare-covered stay in NHs than other Medicare beneficiaries in the same age group (National Center for Health Statistics, 2006).

NH residents with dementia incur high healthcare costs (Harrow, et al., 1995). The cost of care is currently estimated at $68,964 for a NH residents with dementia compared to $24,250 for a community-dwelling PWDs (Alzheimer's Association, 2011). Medicare and Medicaid spent much more for PWDs than other beneficiaries in the same age group. Medicare payments for PWDs are three times higher than average Medicare payments for other Medicare beneficiaries in the same age group. In 2004, Medicare spent $19,034 for a PWD compared to $6,720 for another non-demented Medicare beneficiary in the same age group (Alzheimer's Association, 2011). Medicaid payments for Medicare beneficiaries aged 65 and older with dementia were more than nine times higher than Medicaid payments for other Medicare beneficiaries in the same age group. In 2004, Medicaid spent an average of $8,419 for a Medicare beneficiary aged

65 and older with dementia compared with $915 for other Medicare beneficiaries in the same age group. Total payments for PWDs in 2011 are expected to be $183 billion, including $130 billion for Medicare and Medicaid (Alzheimer's Association, 2011).

The NH residents with dementia are older, more cognitively impaired, have greater medical comorbidity, and are more likely to exhibit disruptive behaviors than community-dwelling PWDs (Kopetz, et al., 2000). Disruptive behaviors occur in the majority of NH residents with dementia (Ballard, Margallo-Lana, et al., 2001; Brodaty, et al., 2001; Margallo-Lana, et al., 2001; Schonfeld, et al., 2007; Suh, 2004; Wood, et al., 2000), and one of the most common reasons for a PWD's NH admission is the persistent occurrence of disruptive behaviors and the difficulty of behavioral management (Gaugler, et al., 2010).

Types of Disruptive Behaviors

Three disruptive behaviors are most prominent in the current literature: wandering behaviors, agitated behaviors, and aggressive behaviors (Aalten, et al., 2006). Less common disruptive behaviors discussed in the literature include repetitive vocalization, sexual disinhibition, delusions, and hallucinations. These occur less frequently (ranging from 9% to 36%) than wandering, aggression, and agitation (Palese, et al., 2009; Volicer, et al., 2007). PWDs who manifested disruptive behaviors had lower heath related quality of life (Cordner, Blass, Rabins, & Black, 2010).

Wandering

Wandering is defined 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, elopement attempts or getting lost unless accompanied (Algase, Yao, et al., 2007)." Wandering behavior is considered a purposeful expression of a PWD's adaptive responses or coping strategy to deal with effects of dementia (Algase, Yao, et al., 2007; Lai & Arthur, 2003). Wandering has five aspects: persistent walking, repetitive walking, eloping behaviors, spatial disorientation, and negative outcomes (Algase, Moore, Vandeweerd, & Gavin-Dreschnack, 2007). The defining attributes of wandering are being frequent and repetitive, being purposeful, and having predictable pattern such as lapping or pacing (Algase, Son, et al., 2004; Algase, Yao, et al., 2007)

Wandering behaviors in PWDs are very common and among the most stressful patient behaviors for caregivers (Ata, et al., 2010; Hong & Song, 2009). The prevalence or incidence of wandering is 20% to 67% as noted in research studies (Lai & Arthur, 2003; Volicer, 2007). The Alzheimer's Association (2007) warned that about 60% of PWDs will have wandering behaviors. Sconfeld and colleagues (2007) reported that the proportion of wandering was 20% among 15,092 residents with moderate or severe cognitive impairment from 134 NH facilities operated by the Department of Veterans Affairs. Sink and colleagues (2004) wrote that the prevalence of wandering was 67% using data from 5,776 Medicare patients enrolled in the Medicare Alzheimer's Disease Demonstration and Evaluation study at eight sites across the United States between 1989 and 1991. Holtzer and colleagues (2003) reported that prevalence of wandering was 39% to 57% using data from 236 PWDs in a cohort study with a follow-up of five years. Matsuoka and colleagues (2003) reported the prevalence of wandering was 54% in 730 patients at 180 units that have specialized psychiatric beds for acute or long term care of PWDs. Hwang and colleagues (1997) reported that one-half of PWDs who were consecutively admitted to the geropsychiatric ward had wandering behaviors.

Aggression

Aggression is defined as an overt act, involving the delivery of noxious stimuli to (but not necessarily aimed at) another organism, object or self, which is clearly not accidental, and includes physically or verbally abusive behaviors and threatening behaviors (Nösman, et al., 1993; Patel & Hope, 1992; Perlman & Hirdes, 2008; Ryden, 1988). Three dimensions of aggression are: a normal/adaptive reaction, a violent reaction, and a functional reaction (Jansen, Dassen, & Moorer, 1997). Aggressive behaviors, commonly directed toward NH staff or caregivers, include verbally and physically abusive behaviors. Physically abusive behaviors include hitting, pushing, kicking, biting, spitting, grabbing, scratching, and throwing objects. Verbally abusive behaviors include disruptive vocalization, threatening, and cursing.

Aggression occurs in about 21% to 82% of NH residents with cognitive impairments. Brodaty and colleagues (2001) reported that aggression occurred in 82% of 647 residents in 11 Sydney nursing homes. Kunik and colleagues (2007) reported that 75% of their sample manifested aggression measured by the Ryden Aggression Scale using data from 385 PWDs at the Veterans Affairs Medical Center in Houston, Texas. Voyer and colleagues (2005) reported that 21 % of 2,332 older adults in long-term care facilities in the Quebec City area displayed physically aggressive behavior and 21.5% displayed verbally aggressive behavior. Schreiner (2001) reported that approximately one-half of the sample manifested aggressive behavior during a two-week study period involving 391 elderly nursing home residents with dementia in Japan. Chen and colleagues (2000) reported that aggression occurred in 64% of the sample of 125 heterogeneous minority elderly PWDs.

Agitation

Agitation is defined as an unpleasant state of excitement with an excessive, inappropriate, repetitive, non-specific, and observable nature experienced by the PWDs (Kong, 2005). Agitated behaviors include irritability, restlessness, frustration, excessive anger, constant demands for attention and reassurance, repeated physical movements or questions. Associated attributes of agitation are inappropriate and excessive motor or vocal activities (Taft, 1989).

Agitation occurs in about 48% to 83% of NH residents with dementia. Suh (2004) reported that 83% of 257 elderly NH residents with dementia in South Korea manifested agitated behaviors at least once a week. Ballad and colleagues (2001) reported that 55% of subjects manifested agitated behaviors among 136 elderly NH residents with dementia. Margallo-Lana (2001) reported that 48% of subjects exhibited agitation in a study using data from 137 elderly residents with dementia in three nursing homes in North East England. Wood and colleagues (2000) reported that agitation occurred in 67% to 84% of the cases in a study observing 69 NH residents.

Summary

Disruptive behaviors, including wandering, aggression, and agitation, are common in NH residents with dementia. Many PWDs display clinically significant disruptive behaviors during the course of their illness. These behaviors present negative consequences to NH staff and the residents themselves.

Consequences of Disruptive Behaviors

Disruptive behaviors are problematic to both PWDs and NH staff. Disruptive behaviors are associated with injuries, hospitalization, or decreased health related qualify of life among PWDs (Aud, 2004; Beattie, et al., 2005; Doorn, et al., 2003; Kunik, et al., 2010). They also contribute to staff stress and burnout (Allen-Burge, et al., 1999; Norton, Allen, Snow, Hardin, & Burgio, 2010).

Consequences to PWDs

The consequences of disruptive behaviors to PWDs are described as follows:

Injury

Wandering PWDs can elope from the NH and get lost, enter physically unsafe areas and get injured or suffer from heat or cold exposure, drowning, or being struck by a car (Beattie, et al., 2005). NH residents with dementia are 74% more likely to sustain injuries associated with fall accidents, relative risk (RR) = 1.74, 95% confidence interval (CI) [1.34, 2.25] (Doorn, et al., 2003). Aud (2004) reported that 62 elopement incidents in 50 NHs in Missouri between January 1999 and June 2001 were recorded at the Missouri Department of Health and Senior Services, and 30% of PWDs who eloped had fallen and were injured. Kunik and colleagues (2010) found that aggressive PWDs showed an increased use of psychotropic medications (0.2 persons/year to 0.41 persons/year, $p < 0.04$), and a 10-fold increase in injuries (0.02 persons/year to 0.21 persons/year, $p < 0.0001$).

Hospitalization and death

Matsuoka and colleagues (2003) indicated that wandering behaviors were strongly related to hospitalization among 730 inpatients from 180 units with specialized psychiatric beds for acute or long-term care of dementia. Suh and colleagues (2005) reported that wandering PWDs were about two times more likely to die, RR = 1.89, 95% CI [1.18, 3.02].

Quality of life

Disruptive behaviors are associated with decreased health related quality of life (QoL). Cordner and colleagues (2010) indicated residents with dementia who had behavior problems had lower QoL, $p = .01$, 95% CI [-11.60, -1.30], among 119 residents at three NHs in Maryland. Wetzels and colleagues (2010) reported that agitation was a strong predictor of poor QoL among 288 individuals with dementia who reside in 14 special care units in 9 NHs.

Consequences to NH Staff

Disruptive behaviors have important clinical consequences, such as increased demands on staff resources, and are associated with staff stress or burnout because wandering requires intensive staff supervision due to possible injury from falls or elopement (Kiely, Morris, & Algase, 2000). Physical aggression, including pushing, spitting, grabbing, kicking, and hitting, are associated with staff burnout and turnover (Allen-Burge, et al., 1999). Norton and colleagues (2010) reported that certified nursing assistant burden was significantly associated with disruptive behaviors of NH residents with dementia, $R^2 = 0.246$, $p = 0.002$.

Managements of Disruptive Behaviors

There are three approaches to managing disruptive behaviors: physical restraint, pharmacological intervention, and nonpharmacological intervention. It is generally accepted that physical restraints should be avoided as much as possible and used only as a last resort to protect a PWD's safety. Most experts suggest that nonpharmacological interventions should be used before pharmacological interventions, and medication should be judiciously used and time-limited because of their side effects (Sink, et al., 2005; Tripathi & Vibha, 2010)

Physical Restraint

Physical restraints, defined as any device or equipment that inhibits mobility or change in position and is not easily removed by the person who is being restrained, are still employed in NHs, despite federal regulations limiting their use (Gallinagha, 2002; Hamers, et al., 2004). Bartels and colleagues (2003) reported that agitated NH residents with dementia had a high prevalence of physical restraints (29%) compared to uncomplicated NH residents with dementia (19%) in 2,487 physically frail older residents from 109 long-term care facilities. Kirkevold and colleagues (2003) stated that physical restraints were used on 67% of NH residents in Norway. NH residents with dementia are more likely to be physically restrained than cognitively-intact NH residents. Huabin and colleagues (2011) reported that NH residents with dementia were more likely to be physically restrained than those residents without the condition (9.99% versus 3.91%, $p < .001$) using data from the 2004 National Nursing Home Survey. The application of physical restraints causes much physical harm and violates ethical principles of respect for autonomy and promotion of overall wellbeing.

Physical restraints lead to functional disabilities or aggravated disruptive behaviors (Cotter, 2005). Restrained people often suffer from urinary incontinence and constipation, pressure ulcers, increased dependence in activities of daily living, and impaired muscle strength and balance. Other harms associated with restraint use are bruises, contractures, cardiac stress, lower extremity edema, and injuries such as fractures and falls (Gastmans & Milisen, 2006). Psychological harms, such as increased confusion and agitation, are also associated with physical restraints (Flannery, 2003). Capezuti and colleagues (2002) reported that use of side rails did not seem to significantly reduce the likelihood of falls or serious injuries in 463 residents from three nonprofit NHs. Wang and colleagues (2005) reported that there is no scientific evidence that physical restraints actually protect residents against injuries in a critical literature review published between 1992 and 2003 on the use of physical restraints on residents with dementia in long-term care. Huabin and colleagues (2011) reported that the use of trunk restraints was associated with a higher risk for falls (adjusted odds ratio = 1.66, $p < .001$) and fractures (adjusted odds ration = 2.77, $p < .01$) using data from the 2004 National Nursing Home Survey. Voyer and colleagues (2005) reported that residents with physical restraints were 43% more likely to manifest agitated behaviors (OR = 1.43) using data from 2,332 older adults in long-term care facilities in the Quebec City area.

With person-centered care, there is an increased concern about the loss of dignity and loss of autonomy that is imposed by the use of physical restraints (Touhy, 2004). Even PWDs should be treated as persons with dignity. Personal dignity cannot be abandoned through illness or disease. This value gives rise to the ethical norm that caregivers must prioritize respect for the dignity of PWDs. The use of physical restraints poses a big risk to personal dignity (Gastmans & Milisen, 2006).

Disruptive behaviors could be interpreted as a kind of bodily autonomy (Algase, Yao, et al., 2007; Cohen-Mansfield, 2000). They can be considered as meaningful bodily expressions that tell us something about the person's wishes (Algase, Yao, et al., 2007). For example, a disruptive behavior might be a request for pain management. Disruptive behaviors can be interpreted as a meaningful answer to extreme circumstances from somebody who once was a real person. The use of physical restraints as a disruptive behavior management mechanism for PWDs violates the respect for autonomy.

Pharmacological Intervention

Despite federal regulations limiting medication use for behavioral symptoms and their potential side effect, pharmacological interventions using psychoactive medications are commonly used for NH residents with dementia in the setting of acute crisis (Cohen-Mansfield & Jensen, 2008; Goldberg, 2002). The psychotropic medications are associated with decreased health related quality of life, and increased risk for sedation, extrapyramidal symptoms, and fall (Ballard, O'Brien, et al., 2001; Sink, et al., 2005). The most common pharmacological interventions are cholinesterase inhibitors, antipsychotics, antidepressants, and mood stabilizers, but there is no standard of care (Hersch & Falzgraf, 2007; Sink, et al., 2005).

Richter and the colleagues (in press) reported that at least one psychotropic medication was prescribed to about three-fourths of NH residents in Austria and more than half of NH residents in Germany to manage disruptive behaviors using data from 5,336 residents in 136 NHs. Tija and colleagues (2010) reported that 53% residents took at least one psychotropic medication daily among 323 residents with advanced dementia from 22 NHs at Boston-area. Petek-Ster and Cedilnik-Gorup (2011) described that 73% residents had a prescription of at least one psychotropic medication among 2040 residents aged 65 years and older in 12 NHs in Slovenia between September 25 and November 30, 2006.

Cholinesterase inhibitors

The cholinesterase inhibitors, such as donepezil, rivastigmine and galantamine, are used as a safe measure to prevent disruptive behaviors. Rodda and colleagues (2009) suggested that cholinesterase inhibitors have limited efficacy, but can be an appropriate pharmacological intervention to manage disruptive behaviors using a systematic review of 14 randomized, placebo controlled trials.

Antipsychotics

Antipsychotics are somewhat effective in managing disruptive behaviors, but produce numerous side effects. Atypical antipsychotic medications (e.g., clozapine, risperidone, olanzapine, quetiapine) produced fewer side effects compared to typical antipsychotics (e.g., chlorpromazine, trifluoperazine, thioridazine, thiothixene, haloperidol, loxapine, and perphenazine), but are still associated with the development of extrapyramidal signs, sedation, increased incidence of strokes, and higher mortality rates.

Schneider and colleagues (2005) reported that PWDs have a 54% increase in death in antipsychotic medication users ($p = .02$). Sink and colleagues (2005) found that atypical antipsychotics, especially risperidone and olanzapine, are better than other medications to manage disruptive behaviors, but also pose increased risk of cerebrovascular events. Ballard and colleagues (2006) also found that atypical antipsychotics, particularly risperidone and olanzapine, reduce wandering behaviors, but have significant cardiovascular and motor side effects.

Antidepressants

Antidepressants, such as trazodone, fluoxetine, sertraline, paroxetine, fluvoxamine, citalopram, are used to manage disruptive behaviors. However, these antidepressants can result in sedation, orthostatic hypotension, and gastrointestinal side effects that include nausea, diarrhea, and weight loss (Herrmann, 2001).

Rojas-Fernandez (2003) suggested trazodone is useful to manage disruptive behaviors in PWDs in a study using 11 PWDs. Finkel and colleagues (2004) reported that sertraline is effective to reduce behavioral and psychological symptoms of dementia in a sub-group of patients with moderate-to-severe symptoms of dementia, but diarrhea was significantly ($p < 0.05$) more common in the donepezil and sertraline group compared to the donepezil and placebo group using data from 24 patients who were treated with donepezil and sertraline and 120 patients with donepezil and placebo. Pollock and colleagues (2002) reported that patients treated with citalopram manifested significantly greater improvement in agitated or aggressive behaviors than those receiving placebo, but 52% of patients with citalopram dropped out of the study mainly due to lack of efficacy and adverse events, among 85 hospitalized PWDs with at least one moderate to severe aggression, agitation, hostility, suspiciousness, hallucinations, or delusions.

Mood stabilizers

Mood stabilizers, such as sodium valproate, divalproex sodium, and carbamazepine, are often used to manage disruptive behaviors. These medications are also grouped as anxiolytics or anticonvulsants. These medications can cause sedation, nausea or vomiting, diarrhea, and unsteady gait (Herrmann, 2001).

Sival and colleagues (2002) reported that treatment with sodium valproate (480mg/day) was not effective to control aggressive behavior compared to placebo among 42 PWDs at a psychogeriatric short-stay ward at a psychiatric teaching hospital. Porsteinsson and colleagues (2001) showed that divalproex treatment reduced agitation, but not statistically significant ($p = 0.06$), and more frequent adverse effects with divalproex than placebo (39% adverse effects with divalproex versus 11% with placebo, $p = .03$) among 56 NH residents with dementia who have agitation. Olin and colleagues (2001) reported that carbamazepine was effect in reducing hostility in 21 PWDs who had not responded to antipsychotics, but adverse events (mostly diarrhea and vomiting) were occurred in 44% of patients taking carbamazepine.

Non-Pharmacological Intervention

There are three approaches to nonpharmacological interventions for managing disruptive behaviors in PWDs: patient-centered intervention, environment-centered intervention, and caregiver-centered intervention (Remington, Abdallah, Melillo, & Flanagan, 2006). Patient-centered interventions include reminiscence therapy, pet therapy, and stimulated presence therapy. Environment-centered interventions include music therapy and environmental modifications using landmarks, visual barriers or technology. Caregiver-centered interventions include simplification and structuring, multiple cueing, and reinforcement. These non-pharmacological interventions are generally recommended to attempt before initiating drug therapy (Sink, et al., 2005).

Patient-centered intervention

Patient-centered intervention refers to reality orientation intervention, which helps PWDs be more aware of themselves in relation to the place and time. Reminiscence therapy, pet therapy, and stimulated presence therapy are often used as patient-centered interventions. Reminiscence therapy using memory aids, such as pictures or diaries, is used to improve self-esteem in the PWDs. Haight and colleagues (2006) reported that a life review or life storybook intervention improved communication, positive mood, and cognition in 30 NH residents with dementia in Northern Ireland.

Pet therapy is used as an effective approach to manage or reduce disruptive behaviors by providing sensory stimulation and comfort to PWDs. Kanamori and colleagues (2001) showed that pet therapy reduced disruptive behaviors in seven PWDs in a day care center. Libin and

Cohen-Mansfield (2004) showed that even robotic animal therapy reduced agitated behaviors in nine NH residents with dementia. Takanori (2004) found that a robot pet offers direct reassurance and calming, the diversion of attention, and behavioral cuing. The robot pet might resist being taken out of the NH by whimpering convincingly when taken outside, or by verbally requesting that the PWD please take it back to NH. The pet could also relay information on PWDs' physiologic states or agitation level to the NH staff who may then take appropriate action to calm and reassure the PWD.

Simulated presence therapy, using personalized conversation on video or audio tape, can be used to reduce disruptive behaviors in PWDs. Camberg and colleagues (1999) reported that simulated presence consisting of playing a personalized audiotape of a family member's telephone conversation about valuable memories through a headset reduced agitation in 54 NH residents with dementia in nine nursing homes in Eastern Massachusetts and Southern New Hampshire.

Environment-centered intervention

Environment-centered intervention refers to alterations in the environment that compensate for impaired cognition and function. Environment-centered interventions include music therapy and environmental modifications. Music has been shown to reduce disruptive behaviors in PWDs (Goodall & Etters, 2005). Clark and colleagues (1998) reported that a resident's favorite music reduced aggression in 18 NH residents with dementia. Hick-Moore (2005) also reported that reduction in agitated behaviors were achieved during the weeks of music therapy participated by 13 subjects residing in a special care unit over a four-week period. Sherratt and colleagues (2004) reported that live music significantly reduced disruptive behaviors in 24 PWDs. Svansdottir and Snaedal (2006) found that music therapy significantly reduced disruptive behaviors using data from 38 NH residents with dementia.

Environmental modification, such as the use of landmarks, visual barriers or technology, is based on the assumption that disruptive behaviors occur when PWDs experience either excessive or insufficient environmental demand in relation to their ability. When environmental demand exceeds PWD's ability, individuals experience excess disability, and function as if they are more impaired than they really are. When PWD's ability exceeds environmental demand, individuals are not challenged or stimulated to use preserved abilities and may subsequently lose them at an accelerated rate (Calkins, 2004; Richards & Beck, 2004; Smith, Gerdner, Hall, & Buckwalter, 2004). There have been reports of particular environmental features preventing injury and creating a sense of well-being for the resident (Fleming & Purandare, 2010). The general trend of environmental perspective is that the modification of the environment enables PWDs to move about in a safe, non-intrusive manner within the structure (Day, Carreon, & Stump, 2000).

Baskaya and colleagues (2004) noted that landmarks, such as a large plant or a distinctive piece of furniture, are widely used in NH facilities to visually hint decision points of a building and differentiate hallways. The presence of landmarks using signs reduces confusion or agitation levels when PWDs move around inside the NH. However, vision changes associated with aging and dementia may reduce the effectiveness of landmarks (Cronin-Golomb, 1995).

Roberts (1999) suggested that door visual barriers and taped grid patterns affixed to the floor in front of exit doorways reduces wandering behaviors in PWDs. Feliciano and colleagues (2004) reported that a cloth barrier reduced entry into an unsafe area in one 53-year-old woman with moderate mental retardation, bipolar disorder, and probable dementia. Kincaid and Peacock (2003) reported that a wall mural painted over an exit door reduced wandering behaviors in 12 NH residents with dementia. Several other studies have shown that a taped grid pattern on the floor is effective in preventing wandering behaviors of PWDs (Chafetz, 1990; Hewawasam, 1996).

McShane and colleagues (1988) suggested that exit control and provision of the least-restrictive environment using digital technology, such as electronic tagging or tracking devices, sensory pads, and alarms, can help prevent wandering. Algase and colleagues (2003) reported that StepWatch, a biomechanical activity device that index wandering behaviors in NH residents with dementia, was acceptable to NH staff because it explained the most variance of all electronic devices. The PWDs wear a transmitter shaped like a watch, pager, or ankle bracelet and are located by central monitoring systems in NHs. Tracking devices on PWDs can provide the location of a PWD at any moment, and report if they have fallen or gotten injured. Location aware systems can be used to prompt behaviors as have been shown by several demonstration projects, including the University of Florida's Smart House, which employs tiny radio frequency identification devices located in the physical environment or occupants' clothing to prompt wearer behavior contingent on their location by proximity to a scanning device. Such devices might warn a NH staff if a PWD tries to get out of the NH when they touch exit door knobs. There are some concerns that electronic tagging or tracking devices breach autonomy and personal dignity (Robinson, et al., 2007), but these technology solutions are able to protect the PWDs from harmful situations while preserving their rights and dignity.

Caregiver-centered intervention

Staff psycho-education on how to interact with PWDs reduces disruptive behaviors in PWDs. Simplification and structuring, multiple cueing, and reinforcement are commonly used in NHs (M. F. Weiner & Teri, 2003). Simplification and structuring refers to reducing the number and complexity of demands and organizing tasks in simple steps to meet PWDs' personal needs. Multiple cueing refers to using multiple stimuli to initiate or maintain required activities.

Reinforcement involves the process of encouraging positive behaviors. These staff education modules are reported to reduce disruptive behaviors (Lucero, 2002).

Summary

There is no definite intervention that is universally effective in treating disruptive behaviors of PWDs. The management of these disruptive behaviors should use individualized systematic approaches to include patient-related factors, caregiver-related factors, and environment-related factors (Ayalon, Gum, Feliciano, & Arean, 2006; Connor, et al., 2009; Herrmann, 2001; Kutsumi, Ito, Sugiura, Terabe, & Mikami, 2009), as well as using nonpharmacological interventions before resorting to pharmacological interventions.

Most pharmacological interventions for disruptive behavior can result in significant side effects, so they should be used cautiously and monitored by healthcare providers. Nonpharmacological interventions are the mainstay of management of disruptive behaviors in PWDs (Desai & Grossberg, 2001), including NH staff education on non-confrontation, simplification, structuring, multiple cueing, repetition, guiding and demonstration, reinforcement, and reducing choices (Kutsumi, et al., 2009; M. F. Weiner & Teri, 2003). Also, physical restraint should be avoided as much as possible due to risks of physical and psychological harms.

Pain in Nursing Home Residents

Prevalence of Pain

Pain is a complex phenomenon derived from sensory stimuli or neurologic injury and modified by individual memory, expectation, and emotions (American Geriatric Society, 2002). Pain is a common condition among NH residents. Using data from 123 NH residents with advanced dementia at three NHs in Maryland, Black and colleagues (2006) reported that 63% of these residents recognized pain. Jones and colleagues (2006) reported that 60% of 2,033 residents from 12 NHs located in both urban and rural areas in Colorado conveyed pain. Zanocchi and colleagues (2008) reported that chronic pain prevalence was 83% in 105 residents at two nursing homes in Italy. Cohen-Mansfield (2004) reported that 34% to 39% of residents suffered from pain as indicated on MDS assessment data on 80 NH residents. Horgas and Dunn (2001) reported from a sample of 45 NH residents that 49% of them experienced pain in the past week. Achterberg and colleagues (2010) reported that the prevalence of pain varied 32% among 1,959 patients at 31 facilities in Italy, 43% in 2,295 patients at eight facilities in the Netherlands, and 57% in 5,761 patients at 64 facilities in Finland. Smalbrugge and colleagues (2007) stated that pain prevalence was 68% among 350 elderly NH-patients from 14 Dutch NHs. Zwakhalen and colleagues (2009) wrote that 47% of NH residents with dementia experienced pain to some extent using data from 117 residents at three Dutch nursing home dementia special care units. Teno and colleagues (2004) reported that the prevalence of daily excruciating pain was 3.7% using 2,138,442 MDS assessment data points in the U.S. that were completed around April 1999. The prevalence of daily excruciating pain varied from 1.9 % (New York) to 6.8% (California).

Under-recognition of Pain

Pain is underreported in NH residents with dementia (Cohen-Mansfield, 2004; Horgas, et al., 2009; Parmelee, Smith, & Katz, 1993; Sengupta, et al., 2010). Sengupta and colleagues (2010) reported that 17% of NH residents with dementia showed pain while 29% of NH residents without dementia showed signs or symptoms of pain using data from the 2004 National Nursing Home Survey. Horgas and colleagues (2009) wrote that cognitively impaired elderly people self-report less pain than cognitively intact elderly people, but behavioral pain indicators do not differ between cognitively impaired and intact groups in a sample of 64 cognitively intact and 62 cognitively impaired older adults. Cohen-Mansfield (2004) reported that persons with mild or moderate cognitive impairment were rated by the MDS as having more pain than those with severe impairment among 80 NH residents, and suggested this is because persons with severe cognitive impairment have a decreased ability to adequately communicate the nature and extent of the pain. Using data from 758 elderly institution residents, Parmelee and colleagues (1993) reported that PWDs were less likely to report pain, even though examination of possible physical causes of reported pain revealed no differences between pain reports of cognitively impaired versus intact individuals.

In summary, pain assessment using self-report instruments is not enough for NH residents with dementia. When using self-report instruments to evaluate pain in NH residents, it is important to be aware of the presence of cognitive or communicative impairments that may influence the instrument's feasibility and reliability. PWDs' ability to remember, interpret, and respond to pain is altered so that they are often unable to properly articulate or convey their pain intensity. More comprehensive pain assessment is needed when assessing pain in PWDs, and should include observational measures in addition to self-reported pain scores.

Pain Experience

PWDs do not experience less pain, but rather experience pain similar to cognitively intact individuals or even increased pain affect in some types of dementia (Gibson, Voukelatos, Ames, Flicker, & Helme, 2001; Scherder, et al., 2003). Gibson and colleagues (2001) wrote that the subjective rating of evoked pain and the level of post-stimulus cortical activation following noxious stimulation in PWDs were similar to those of cognitively intact older adults using data from 15 PWDs and 15 cognitively intact older adults. Scherder and colleagues (2003) reported that persons with vascular dementia had increased pain as measured by the colored analogue scale for pain affect and the faces pain scale compared to cognitively intact persons using data from 20 patients with possible vascular dementia and 20 cognitively intact older adults who had comparable pain conditions.

Under-treatment of Pain

There is ample evidence that NH residents with dementia are inadequately treated for pain. Sengupta and colleagues (2010) reported that 56% of non-Caucasian NH residents with dementia lacked relevant pain treatment compared to 44% of non-Caucasian cognitively intact NH residents as reflected in data from the 2004 National Nursing Home Survey. Reynolds and colleagues (2008) also found that 56% of residents with severe impairment received pain medications, while 80% of residents with no cognitive impairment received pain medications ($p < 0.001$) using data from 551 residents in six North Carolina NHs. Morrison and Siu (2000) reported that advanced dementia patients who had hip fractures received significantly less amounts of opioid analgesia compared to their cognitively intact counterparts using data from 59 cognitively intact elderly patients and 38 advanced dementia patients with hip fracture. Won and colleagues (1999) stated that NH residents with cognitive impairments were 44% more likely not to receive pain medications using data from 49,971 NH residents, OR = 1.44, 95% CI [1.29, 1.61]. Horgas and Tsai (1998) found that NH residents with cognitive impairments were prescribed and administered significantly less analgesic medication, both in number and in dosage of pain drugs, than their cognitively intact peers as seen in 339 NH residents from four nursing homes in Western Pennsylvania.

Consequences of Pain

Pain management is closely related to health related quality of life in PWDs. Cordner and colleagues (2010) revealed that residents who received pain medication had a higher health related quality of life using data from 119 NH residents with dementia from three NHs in Maryland, $p = .006$, 95% CI [3.30-19.59]. Adequate pain assessment and effective treatment using observational strategies improves health related quality of life in PWDs, reflecting an improvement in feelings and mood, enjoyment of activities, and social interaction. Won and colleagues (2006) found that long-acting opioids improved functional status compared with short-acting opioids without adverse events (i.e., constipation, delirium, dehydration, pneumonia, changes in cognition or mood status, increased risk of depression) in a longitudinal study of 10,372 NH residents with persistent pain, adjusted hazard ratio = 1.85, 95% CI [1.05, 3.23]. Lee and colleagues (2006) reported that residents who had more pain were more likely to have distressed moods and consequently a higher incidence of terminal restlessness based on 84 decedents' MDS assessment data.

Summary

Pain prevalence is high among NH residents with or without dementia, ranging from 50% to 80%. However, NH residents with dementia have cognitive and communicative impairments as symptoms of dementia thereby hampering effectively verbalization of their pain intensity. Thus, they did not have adequate pain treatment, causing a decline in feelings and mood, functional status, enjoyment of activities, and social interaction.

The Relationship between Pain and Disruptive Behaviors

The relationship between pain and disruptive behaviors has been examined in several published studies. These studies are summarized in Table 2-4, and discussed in the following section.

Pain and Wandering

PWDs are more likely to wander due to many factors such as the need to address pain and other emotions. In a retrospective cohort study of 8,982 NH residents from Mississippi, Texas, and Vermont who had baseline and three-month follow-up MDS assessment data between January 1996 and December 1997, Kiely and colleagues (2000) demonstrated that NH residents who expressed pain were 65% more likely to develop wandering behaviors than their counterparts who did not using a logistic regression analysis, after controlling for pneumonia, short-term memory, repetitive questions, long-term memory, constipation, antipsychotic medication, ADL impairment, and gender, OR = 1.65, $p = .02$, 95% CI [1.08, 2.53]. The authors dichotomized the MDS wandering item as present (occurred at least once in the last 7 days) or absent (not exhibited in the last 7 days) and used this variables in a logistic regression analysis. The researchers hypothesized that a resident with pain may move about the NH in an effort to relieve his or her pain or unsettled state, but such motivation may be unknown to observers and movement may be perceived as aimless wandering. This view is consistent with the NDB model which hypothesizes that physiological and psychological need states may influence wandering behavior.

There are some limitations in this study. First, because Kiley and colleagues (2000) used the MDS 1.0, they were not able to measure pain appropriately. They measured pain by a dichotomized expression of sadness or pain (0 = *no sad or pained expression*, 1 = *sad or pained expression*) using MDS 1.0. The confounded expression of pain with expression of sadness may not be a valid measurement of pain. Sadness is not the same concept as pain.

Second, the researchers recruited all NH residents from three states. Not all NH residents expressed pain via wandering. Wandering occurred mainly in persons with cognitively impairments, but not in all the older adults or all NH residents (Algase, et al., 1996; Algase, Yao, et al., 2007). There is no reporting that wandering, as defined in the NDB model, is occurred in cognitively intact persons. Thus, by including all NH residents and reporting the relationship between pain and wandering without controlling for their cognitive status, the relationship between pain and wandering in persons with cognitive impairments may be underestimated.

Third, the researcher did not exclude or statistically control the use of physical or chemical restraint. Persons with these restraints cannot wander. Those residents are restrained should be appropriately controlled or excluded from study sample.

Furthermore, this study may have presented more meaningful results if an ordinal logistic regression was used, instead of a binary logistic regression, for multivariate analysis. Collapsing the ordinal wandering outcome into two categories and performing a binary logistic regression results in the loss of valuable information. It is important to use ordinary logistic regression since the response categories of wandering have a 4-point ordered nature (no exhibition, 1- 3 day exhibitions in last 7 days, 4 – 6 day exhibition in the last 7 days, and daily exhibition). By using an ordinal logistic regression analysis, it would be possible to demonstrate how the results change as the dependent variable moves to the next higher category.

Pain and Aggression

The relationship between pain and aggression is inconclusive as seen in two published studies. In the first study, Volicer and colleagues (2009) conducted a study of pain and aggression in Dutch nursing home residents. The sample consisted of 929 residents older than 65 years old with dementia who were dependent in decision making and not comatose, and were collected from eight Dutch nursing homes and 10 residential homes within a 12-month time window for each facility separately, resulting in a time range from April 4, 2007, to December 1, 2008. The authors measured pain by a single MDS item (e.g., pain frequency), physical aggression with a single MDS item (MDS item # E4C) “others were hit, shoved, scratched, or sexually abused,” verbal aggression by another single MDS item (MDS item # E4B) “others were threatened, screamed at, or cursed at,” and dichotomized it as no aggression versus one or more episodes for a logistic regression analysis. The authors reported that pain frequency was significantly correlated with frequency of verbal aggression using a bivariate correlation analysis

(r = .07, p = .028). However, in a logistic regression analysis, after controlling for hallucinations, delusions, ability to understand others, depression, and constipation, pain frequency was not related to the frequency of verbal aggression (OR = .73, p = .116), or the frequency of physical aggression (OR = 0.69, p = .161).

In the second study, Leonard and colleagues (2006) conducted a study of pain and aggression in U.S. nursing home residents. The sample consisted of 103,344 NH residents in five large geographically diverse states (e.g., California, New York, Ohio, Pennsylvania, and Texas) who had at least one annual MDS assessment data completed during 2002. Similar to the aforementioned study, the authors measured the frequency of aggression by a single MDS item, and dichotomized it as no aggression versus one or more episodes for a logistic regression analysis. The authors measured pain by a single MDS item (e.g., pain intensity), and reported that pain intensity was not significantly associated with the frequency of physical aggression in a binary logistic regression analyses, after controlling for depression, delusions, hallucinations, constipation, respiratory tract infection, urinary tract infection, fever, and the amount of time participating in non-ADL or treatment activities such as recreational activities.

These two published studies used MDS assessment and large samples, but they have some limitations. First, both of these studies did not appropriately examine the relationship between pain and aggression in NH residents with dementia. Leonard and colleagues (2006) measured the relationship between pain and aggression in all NH residents, regardless of their cognitive status, in five states. Not all NH residents express pain via aggressive behaviors. The cognitively intact persons residing in these NHs are likely to verbalize their pain level or request pain medications when they felt pain. NH residents with dementia have cognitive and communicative impairments that can cause them to express pain via aggressive behaviors (Algase, et al., 1996; Algase, Yao, et al., 2007). If the researchers excluded or statistically controlled for NH residents without dementia, they may have found a relationship between pain and aggression. Volicer and colleagues (2009) measured pain frequency alone, and not pain frequency together with pain intensity. The comprehensive measurements of pain frequency and intensity in the MDS assessment data would provide more meaningful outcomes. Single item measurement measuring global pain rating is acceptable, but using one item (e.g., pain frequency) from a comprehensive pain scale is not a meaningful measurement (Youngblut & Casper, 1993).

Second, these two studies used single MDS items for measuring the frequency of aggressive behavior. In aggression, there are at least two components, verbal and physical aggressions. Using only one item from a comprehensive aggression scale is questionable because it does not examine the full range of aggressive behavior. The use of the comprehensive MDS-Aggression Behavior Scale (MDS-ABS) (Perlman & Hirdes, 2008), put forward recently in 2008, helps to present more meaningful outcomes. The MDS-ABS is a sum score of four MDS items, and has a continuous format, ranging from zero to 12 with higher scores indicating greater severity of aggressive behaviors. The comprehensive MDS-ABS has better psychometric evidence as compared to single MDS items - an internal consistency reliability of 0.79 to 0.95, and a criterion validity coefficient of 0.72 with CMAI aggression subscale scores (Perlman & Hirdes, 2008).

Third, in these two studies, the researchers did not exclude or statistically control the use of physical or chemical restraint. Persons with these restraints cannot appropriately express aggression. Those residents who put restraints should be appropriately controlled for reporting the meaningful outcomes.

Fourth, these two studies used logistic regression analyses after dichotomizing a single aggression item. These studies could have presented more accurate results using an ordinal logistic regression, rather than binary logistic regression, for multivariate analysis. Collapsing a single MDS aggression response into two categories and performing a logistic regression results in the loss of valuable information.

Pain and Agitation

Several studies have identified pain as one of the most important contributing factors to agitation in NH residents with dementia. Buffum and colleagues (2001) reported that pain measured by a discomfort scale was significantly associated with the frequency of agitation as measured by the CMAI (r = .50, p = .003). This study was conducted with 33 Veterans Affairs NH residents with dementia in an urban, university-affiliated, 120-bed extended care facility within the Veterans Affairs Medical Center.

Manfredi and colleagues (2003) demonstrated that low dose, long-acting opioid treatment reduced the frequency of agitation as measured by the CMAI using a prospective longitudinal design, mean change in CMAI score: -6.4 (95% CI [-10.96, -1.8]). The sample consisted of 13 NH residents with dementia who were more than 85 years old. The authors administered a placebo for four weeks and a long-acting opioid for the next four weeks. No new psychotropic medications were prescribed during the eight-week study period, but necessary psychotropic medications which residents were taking when they entered the study were permitted during the study and their use was recorded.

Villanueva (2003) reported that pain severity was significantly associated with the frequency of agitation in 40 residents from four long-term care facilities, three skilled nursing facilities, and a locked dementia assisted-living facility. Pain severity was measured by the Pain Assessment for the Dementing Elderly (PADE), and the frequency of agitation was assessed by the CMAI. The PADE consists of 24 items and is composed of Part I (physical assessment; observable facial expression, breathing pattern, and posture), Part II (global assessment; allowing the caregiver to rate overall pain of the resident they are caring for), and Part III (functional assessment; ADLs). Part I in PADE (physical assessment; observable facial expression, breathing pattern, and posture) correlates significantly with the CMAI verbal agitation subscale, (r = .296, p < 0.01), and Part III in PADE (functional assessment; ADLs) is significantly associated with physically aggressive, verbal and physical agitation subscales of the CMAI (r = .396, r = .398, r = .421, respectively).

Bartels and colleagues (2003) reported that the prevalence of pain was significantly associated with mixed agitation and depression in 2,487 physically frail older residents with dementia from 109 long-term care facilities. Agitation was assessed by documentation of signs of agitated behaviors in medical record, and categorized 3-levels, with no agitation, moderate agitation, and severe agitation. Pain was dichotomized based on medical chart review. Thirty-four percent of PWDs with mixed agitation and depression exhibited pain, whereas only 23% of uncomplicated PWDs exhibited pain (chi-square = 36.20, p < .0001).

Norton and colleagues (2010) used secondary analysis of prospective data in 169 residents from 10 nursing homes in Birmingham, Alabama, and reported mixed findings with regard to the relationship of pain and disruptive behaviors. A multiple regression analysis revealed that weekly resident pain intensity reported by certified nursing assistants (CNAs) were significantly associated with the frequency of disruptive behaviors as measured by the Revised Memory and Behavior Problem Checklist-Nursing Home (RMBPC-NH) after controlling for cognitive impairments, gender, ethnicity, and ADL functional status (β = 0.183, p = .04). However, the number of painful diagnoses and analgesic medication administration seen in the chart review were not significantly associated with disruptive behaviors as measured by subscales within the RMBPC-NH. The authors could not control data because it is a secondary analysis and there may be some variability due to different styles and skills among raters.

In summary, these published studies showed a significant relationship between pain and agitation, but there are some gaps or limitations in the literature. First, the two published studies (Buffum, et al., 2001; Manfredi, et al., 2003) on the relationship between pain and agitation in the NH residents with dementia used small sample sizes, ranging from 13 to 33. Generalizability of findings may be limited by the small sample size. Also, in these two published studies, the researchers did not control for the use of restraints. Residents with restraints will manifest agitation differently.

Second, the other three published studies (Bartels, et al., 2003; Norton, et al., 2010; Villanueva, et al., 2003) included all NH residents and did not report the relationship between pain and agitation after controlling for cognitive status. Not all NH residents express pain via agitated behaviors; agitated behaviors are more common among NH residents with dementia.

Furthermore, none of the studies used the MDS-Challenging Behavior Profile (MDS-CBP) agitation subscale or large-scale data. The MDS-CBP agitation subscale is a sum score of four MDS items, ranging from 0 to 7, with higher scores indicating more agitated behaviors. The MDS-CBP agitation subscale has an internal consistency reliability of 0.70, inter-rater reliability of 0.61, and a Spearman's rank correlation coefficient of 0.50 with behavior rating scale for psychogeriatric inpatients (Gerritsen, et al., 2008). Using the MDS-CBP agitation subscale in a large sample size may provide more meaningful findings with increased generalizability.

Summary

There are only two published studies on the relationship between pain and disruptive behaviors in U.S. Nursing Home residents with dementia (Buffum, et al., 2001; Manfredi, et al., 2003). The other studies used all NH residents (not NH residents with dementia) or NH residents in other countries. In these two studies, the sample sizes were very small, ranging from 13 to 33, thereby limiting their generalizability of findings. Most of the published studies on the relationship between pain and disruptive behaviors recruited NH residents, but did not focus on only NH residents with dementia or report their findings after controlling for the cognitive status of the participants. Not all NH residents express pain through disruptive behaviors such as wandering, aggression, and agitation. PWDs have cognitive and communicative impairments that can cause their unmet needs, such as pain management, to be expressed through disruptive behaviors (Algase, et al., 1996; Algase, Yao, et al., 2007).

Most of the studies investigating the relationship between pain and wandering or aggression used a binary logistic regression for multivariate analysis, but wandering and aggression are measured by ordinal variables. Collapsing the ordinal wandering outcome or ordinal aggression outcome into two categories and performing a logistic regression may result in the loss of valuable information. Those published studies regarding the relationship between pain and wandering or aggression might present more meaningful results if an ordinal logistic regression, rather than logistic regression for multivariate analysis, was used.

The Relationship between Physiological Factors and Disruptive Behaviors

The study of the relationship between pain and disruptive behavior in NH residents with dementia can be complicated by multiple variables that potentially affect disruptive behaviors. The following is a brief review supporting the selection of physiological needs factors. The secondary physiological need states which directly affect disruptive behaviors include hunger, thirst, and elimination (Algase, Yao, et al., 2007). There are a few studies on revealing the relationship between physiological need states. Burgio and colleagues (2001) reported that hunger would be a significant factor to disruptive behaviors. There is an increase in disruptive vocalization around the lunch time using data from 68 elderly NH residents. Nelson (1995) reported that disruptive behaviors was often stopped after providing liquid from qualitative study. Sloane and colleagues (1999) reported that residents with urinary incontinence were two times likely to develop disruptive vocalization using 203 residents from 107 skilled nursing facilities.

The Relationship between Background Factors and Disruptive Behaviors

Based on the NDB model (Algase, et al., 1996; Algase, Yao, et al., 2007), background factors are directly associated with disruptive behaviors. The following is a brief review of the relationship between background factors and disruptive behaviors, including cognitive impairments, general health (e.g., comorbidity, pressure ulcers, number of medications, ADL impairments), and sociodemographics (e.g., age, gender, marital status, education, and ethnicity).

Cognitive Impairments and Disruptive Behaviors

Cognitive impairment positively affects disruptive behaviors. PWDs who are more cognitively impaired are more likely to exhibit higher levels of disruptive behaviors (Burgio, Park, Hardin, & Sun, 2007; Holtzer, et al., 2003; Matsuoka, et al., 2003; Menon, et al., 2001; Norton, et al., 2010; Schonfeld, et al., 2007; Song & Algase, 2008; Vance, et al., 2003; Voyer, et al., 2005). Norton and colleagues (2010) reported that residents who were more cognitively impaired showing higher levels of disruptive behaviors measured by Revised Memory and Behavior Problem Checklist-Nursing Home (RMBPC-NH) using 169 residents from 10 nursing homes in Birmingham, Alabama. Sconfeld and colleagues (2007) reported that severe cognitively impaired NH residents were two times more likely to wandering (OR=2.33, 95% CI= 1.95-2.78) compared to NH residents with moderate cognitive impairments using 15,092 residents with moderate or severe cognitive impairment from 134 NH facilities operated by the Department of Veterans Affairs. Burgio and colleagues (2007) reported that severely cognitively impaired residents manifested more agitation than the moderately impaired group using 78 residents from 5 NHs. Voyer and colleagues (2005) reported that residents with mild-moderate and severe cognitive impairment are more likely to display aggressive behaviors (OR = 2.87 and 3.77, respectively) using data from 2,332 older adults in long-term care facilities in the Quebec City area. Vance and colleagues (2003) reported that more cognitive impaired residents exhibited more agitation using data from 123 residents from five nursing homes located in the Pittsburgh area. Holtzer and colleagues (2003) reported that wandering or agitation increased as a decrement in cognitive status using 236 PWDs in cohort study with follow-up of 5 years. Matsuoka and colleagues (2003) reported the low cognition ability measured by low Mini-Mental Status Examination score was related to aggression among 730 patients from 180 units that have specialized psychiatric beds for acute or long term care of PWDs. Song and colleagues (2008) reported that cognitive impairment measured by lower Mini-Mental Status Examination score was significantly correlated with five subscales of wandering, such as spatial disorientation, attention shift, negative outcomes, persistent walking, and specific patterns using 160 PWDs residing in 14 long-term care facilities in South Korea. Menon and colleagues (2001) reported that aggression were more prevalent among those with greater severity of cognitive impairment ($p < 0.05$) using 1101 residents with dementia from 59 NHs across Maryland. Beck and colleagues (1998) reported that MMSE score negatively correlated with disruptive behaviors using 45 nursing home residents with dementia from 3 NHs in Arkansas and Maryland. Sloane and colleagues (1998) reported that more severe cognitive impairment were related with increased agitation levels using 3723 observations of resident behaviors in 53 Alzheimer's disease Special Care Units in NHs in Kansas, Maine, Mississippi, and South Dakota. Algase (1992) reported using 163 NH residents that wanderers had poorer performance than nonwanderers on neurocognitive dimensions, including memory, attention, language skills, visual-spatial skills.

General Health and Disruptive Behaviors

General health, defined as overall conditions of a person's body, includes comorbidity, pressure ulcer, number of medications, and ADL impairments (Algase, Yao, et al., 2007). Comorbidity is negatively associated with disruptive behaviors, and ADL impairments showed mixed relationship with disruptive behaviors. The relationships between pressure ulcers or number of medications and disruptive behaviors are not reported. The details are discussed below.

Comorbidity and disruptive behaviors

Studies reported a negative relationship between comorbidity and disruptive behaviors. Cohen-Mansfield and Libin (2005) reported that number of medical diagnoses correlated negatively with physically agitated behavior ($r = -0.219$, $p = 0.002$) among 175 elderly PWDs recruited from 11 nursing home facilities in Maryland. Beck and colleagues (1998) reported that the number of diagnoses correlated negatively with aggressive behaviors using 45 nursing home residents with dementia from 3 NHs in Arkansas and Maryland.

ADL impairments and disruptive behaviors

Most of studies reported activities of daily living (ADL) impairment or dependence is positively associated with disruptive behaviors, but some studies reported the opposite relationship. Sconfeld and colleagues (2007) reported that NH residents who were dependent on ADL were two times more likely to wandering (OR = 2.36, 95% CI [1.78-3.14]) compared to NH residents requiring no assistance among 15,092 residents with moderate or severe cognitive impairment from 134 NH facilities operated by the Department of Veterans Affairs. Cohen-Mansfield and Libin (2005) reported that ADL impairment also positively correlated with verbal agitation ($r = 0.235$, $p = 0.001$) among 175 elderly PWDs recruited from 11 nursing home facilities in Maryland. Menon and colleagues (2001) reported that physical aggressive behaviors were more frequent among residents with more limitations in physical functioning ($p < 0.05$) among 1,101 residents with dementia from 59 NHs across Maryland. Beck and colleagues (1998) reported that ADL dependency positively correlated with vocal agitation among 45 nursing home residents with dementia from 3 NHs in Arkansas and Maryland. Sloane and colleagues (1998) reported that higher levels of dependency in ADLs were related with increased agitation levels using 3723 observations of resident behaviors in 53 Alzheimer's disease Special Care Units in NHs in Kansas, Maine, Mississippi, and South Dakota.

In contrast, Zeisel and colleagues (2003) reported that a resident having problems performing ADLs were more likely to have a lower aggression score on the Cohen-Mansfield scale using data from 427 residents in 15 Alzheimer's special care units. Norton and colleagues (2010) reported that residents who were more impaired in ADL performance showed a lower rate of disruptive behavior measured by Revised Memory and Behavior Problem Checklist-Nursing Home (RMBPC-NH) among 169 residents from 10 nursing homes in Birmingham, Alabama. Kiely and colleagues (2000) reported that NH residents with functional impairment were 72% less likely to develop wandering behaviors compared to NH resident without use of antipsychotic medication among 8982 NH residents from the states Mississippi, Texas, and Vermont.

Sociodemographics and Disruptive Behaviors

Sociodemographics are defined as sociological and demographical combined total measure of an individual's or family's social position relative to others (Algase, Yao, et al., 2007). Sociodemographics, including age, gender, marital status, education, ethnicity, are associated with disruptive behaviors in the NDB model (Algase, Yao, et al., 2007). However, in the published literature, all of the sociodemographic factors (e.g., age, gender, marital status, education, and race/ethnicity) showed equivocal or non-significant relationship with disruptive behaviors. The details were discussed below.

Age and disruptive behaviors

The relationship between age and disruptive behaviors is inconclusive. Three published studies (Schonfeld, et al., 2007; Song & Algase, 2008; Zeisel, et al., 2003) reported that age was positively related to disruptive behaviors, the other three studies (Beck, et al., 1998; Brodaty, et al., 2001; Schreiner, Yamamoto, & Shiotani, 2000) reported that age was negatively related to disruptive behaviors, and one study (Eustace, et al., 2001) reported that age was not related with disruptive behaviors. Sconfeld and colleagues (2007) reported that one unit change in age is related to1.02 (95% CI [1.01 - 1.03]) greater odds of wandering behaviors among 15,092 residents with moderate or severe cognitive impairment from 134 NH facilities operated by the Department of Veterans Affairs. Song and Algase (2008) reported that age was significantly positively correlated with wandering factors, such as spatial disorientation, attention shift, and negative outcomes ($r = .29$, $r = .16$, $r = .23$, respectively; $p < .01$) using data from 160 PWDs residing in 14 long-term care facilities in South Korea. Zeisel and colleagues (2003) reported that age was significantly positively correlated with the expression of verbal using 427 residents in 15 Alzheimer's special care units.

In contrast, Schreiner and colleagues (2000) reported that age was negatively associated with wandering ($p < .05$) using data from 392 residents in 6 NHs in Japan. Brodaty (2001) reported that younger NH residents manifested more disruptive behaviors among 647 residents from 11 Sidney nursing homes. Beck and colleagues (1998) reported that age negatively correlated with disruptive behaviors ($p < .05$) among 45 nursing home residents with dementia from 3 NHs in Arkansas and Maryland. Besides, Eustace and colleagues (2001) reported that age was not significantly associated with verbal aggression using 150 PWDs.

Gender and disruptive behaviors

The relationship between gender and disruptive behaviors is inconclusive. Many studies reported that male gender showed more disruptive behaviors than female, but there are some studies reporting disruptive behaviors as being more common in females. Voyer and colleagues (2005) reported that males are about two times more likely to display aggressive behaviors (OR = 2.13) using data from 2,332 older adults in long-term care facilities in the Quebec City area. Matsuoka and colleagues (2003) reported the male gender was significantly related to aggression using 730 patients from 180 units that have specialized psychiatric beds for acute or long term care of PWDs. Zeisel and colleagues (2003) reported that male residents are more likely to show aggression than female residents using data from 427 residents in 15 Alzheimer's special care units. Schreiner (2001) reported that males were significantly more likely to exhibit physically aggressive behavior using 391 NH residents with dementia in Japan. Kiely and colleagues (2000) reported that women were 39% less likely to develop wandering behaviors among 8,982 NH residents from the states of Mississippi, Texas, and Vermont. Menon and colleagues (2001) reported that verbally aggressive behaviors were also more prevalent among males ($p < .05$) among 1101 residents with dementia from 59 NHs across Maryland. Eustace and colleagues (2001) reported that male gender was significantly associated with verbal aggression ($p = .022$) in a stepwise backward logistic regression analysis among 150 PWDs in Ireland. Beck and colleagues (1998) reported that males had a greater frequency of disruptive behaviors ($p < .05$) among 45 nursing home residents with dementia from three NHs in Arkansas and Maryland. Ott and colleagues (2000) reported that men were more likely than women to exhibit disruptive behaviors using Systematic Assessment and Geriatric drug use via Epidemiology (SAGE) database, which contains data collected with the Minimum Data Set on a cross-section of 28,367 NH residents with dementia in five US states.

In contrast, Beck and colleagues (2011) reported that females were two times more likely to show agitation as measured by Cohen-Mansfield Agitation Inventory using data from 138 residents of 17 NHs. Cohen-Mansfield and Libin (2005) reported that females manifested more verbal agitation than males ($p < .001$) among 175 elderly PWDs recruited from 11 nursing home facilities in Maryland. Burgio and colleagues (2000) reported that female residents displayed almost three times the amount of agitation as male residents (35% versus 13% of total observation time, respectively) using data from 46 NH residents with clinically significant agitation. Vance and colleagues (2003) reported that females exhibited more agitation than males using 123 residents from five nursing homes located in the Pittsburgh area.

Marital status and disruptive behaviors

The relationship between marital status and disruptive behaviors is equivocal. Menon and colleagues (2001) reported that physically aggressive behaviors were more frequent among residents who were not married before admission ($p < .001$) among 1101 residents with dementia from 59 NHs across Maryland. On the contrary, Beck and colleagues (1998) reported that married participants were more likely to manifest aggressive behaviors using 45 nursing home residents with dementia from three NHs in Arkansas and Maryland.

Education and disruptive behaviors

The length of education is found to be somewhat negatively associated with disruptive behaviors, but it is not statistically significant. Chen and colleagues (2000) reported that there the length of education had negative associations with disruptive behaviors ($p = .07$) using data from 125 elderly patients with dementia.

Ethnicity and disruptive behaviors

The effect of ethnicity on disruptive behaviors is inconclusive. Sink and colleagues (2004) reported that African-American PWDs were significantly more likely than Caucasian to wander

(OR=1.40, 95% CI: 1.08 - 1.81), and Latinos had a significantly higher likelihood of wandering than Caucasians (OR=1.59, 95% CI: 1.21 - 2.26) using data from 5,776 Medicare patients enrolled in the Medicare Alzheimer's Disease Demonstration and Evaluation study at 8 sites across the United States between 1989 and 1991. However, Cohen and colleagues (1998) reported that African-American dementia patients had significantly lower levels of agitation on the Cohen-Mansfield Agitation Inventory than Caucasian dementia patients using 164 U.S.-born African Americans, 54 African Caribbeans, and 68 Caucasians NH residents with dementia.

Summary

Among ten background factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, and ethnicity), the published literatures showed inconclusive relationships between background factors and disruptive behaviors, with the exception of cognitive impairment and comorbidity. Cognitive impairments are positively associated with disruptive behaviors, and comorbidity is negatively related to disruptive behaviors. The relationship between the other background factors (e.g., pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, and ethnicity) and disruptive behaviors is found to be equivocal or to have no published data.

The Relationship between Background Factors and Pain

Based on the NDB model (Algase, et al., 1996), background factors are significantly associated with pain. The following is a brief review of the effects of background factors on pain, including neurocognitive factors, general health (e.g., comorbidity, pressure ulcers, number of medications, ADL impairments), and sociodemographics (e.g., age, gender, marital status, education, and ethnicity).

Cognitive Impairments and Pain

Cognitive impairments are negatively associated with pain report. Reynolds and colleagues (2008) reported that pain prevalence decreased as cognitive abilities declined like pain prevalence of 34%, 31%, 24%, and 10%, respectively, for residents with no, mild, moderate, and severe cognitive impairment ($p < .001$) using 551 residents from six North Carolina NHs. Black and colleagues (2006) reported that those with pain reports had a significantly higher cognitive function (t = -2.433, df = 119, p = .016) using 123 NH residents with advanced dementia from 3 NHS in Maryland. Teno and colleagues (2004) reported that persons who were more cognitively impaired were less likely to report daily excruciating pain using 2,138,442 MDS assessment data in the U.S. which were completed around April 1999. They reported that persons with the most severe cognitive impairment were 75% less likely to report daily excruciating pain than persons without any cognitive impairment. Fisher and colleagues (2002) reported that more cognitively impaired residents were less likely to report the presence of pain and higher frequency of pain using 57 residents with cognitively impairments from three NHs in the greater Birmingham, Alabama area.

General Health and Disruptive Behaviors

General health is defined as overall condition of a person's body, including comorbidity, pressure ulcer, number of medications, and ADL impairments (Algase, Yao, et al., 2007). All factors regarding general health (e.g., comorbidity, pressure ulcer, number of medications, and ADL impairments) are reported to be positively correlated with pain. The details were discussed below.

Comorbidity and pain

Comorbidity is positively correlated with pain. Black and colleagues (2006) reported that those with pain reports had a significantly higher total number of health problems than those with no pain reports (t = -3.237, df =121, p = .002) among 123 NH residents with advanced dementia from three NHS in Maryland. Reports of pain were significantly related with musculoskeletal, hematologic/oncologic and circulatory disorders, aspiration and trauma or fractures. They showed that aspiration, peripheral vascular disease and musculoskeletal disorders remained significantly associated with pain by regression analysis. Shega and colleagues (2010) reported that comorbidity was positively correlated with pain report (odds ratio = 1.41, 95% CI [1.30 - 1.54]) by logistic regression among cognitively impaired participants among 5,549 older adults. Schuler and colleagues (2004) reported that patients with persistent pain tended to have more comorbidities using 55 patients of acute and rehabilitation wards of a German geriatric hospital.

Pressure ulcer and pain

Pressure ulcer is positively associated with pain. Teno and colleagues (2004) reported that residents with pressure ulcer were 60% more likely to have daily excruciating pain than residents without pressure ulcer (adjusted odds ratio= 1.6) among 2,138,442 MDS assessment data in the U.S. which were completed around April 1999. Gunes (2008) found that 95% subjects reported pressure ulcer pain; of those, 60% reported constant pressure ulcer pain among 47 hospitalized patients admitted for neurological disorders. Nemeth and colleagues (2004) reported pain associated with ulcer using 20 older adults with venous ulcer. Szor and Bourguignon (1999) reported that 42% reported they had a continuous pain due to pressure ulcer even when they were at rest in a sample of 32 adults.

Number of medications and pain

Number of medication is positively associated with pain report. Schuler and colleagues (2004) reported chronic pain was significantly correlated with wider range of medication among 55 patients of acute and rehabilitation wards of a German geriatric hospital.

ADL impairments and pain

ADL impairments are positively associated with pain report. Boerlage and colleagues (2008) reported that pain was associated with limited ADL among 157 residents from three Dutch residential homes. Shega and colleagues (2010) reported that pain was associated with functional impairment (odds ratio = 1.74, $p < 0.01$) and lower self-rated health (odds ratio = 2.35, $p < 0.01$) among cognitively impaired subjects using 5,549 older adults. Teno and colleagues (2004) reported that residents dependent in self-care functions were 2.8 times more likely to have daily excruciating pain using 2,138,442 MDS assessment data in the U.S. which were completed around April 1999.

Sociodemographics and Pain

Sociodemographics are defined as sociological and demographical combined total measure of an individual's or family’s social position relative to others (Algase, Yao, et al., 2007). Sociodemographics, including age, gender, marital status, education, ethnicity, are associated with disruptive behaviors (Algase, Yao, et al., 2007). Most of the sociodemographics factors (e.g., age, marital status, and race/ethnicity) showed equivocal relationship with pain. However, female gender was reported to be positively correlated with pain, and highest level of education was reported to be negatively associated with pain. The details were discussed below.

Age and pain

The relationship between age and pain report is equivocal. Shega and colleagues (2010) reported that age was negatively correlated with pain report (odds ratio=0.97, 95% CI [0.95 - 0.99]) by logistic regression among cognitively impaired participants among 5,549 older adults. Teno and colleagues (2004) reported that daily excruciating pain was more prevalent in younger residents among 2,138,442 MDS assessment data in the U.S. which were completed around

April 1999. They described that persons of age 80 and older were 50% less likely to report daily excruciating pain than those younger than 65 years old.

In contrast, Bruckenthal and colleagues (2009) reported pain incidence generally increase as the population ages. Stranjalis and colleagues (2011) reported that increased age was significantly associated with the presence of neck pain using 1000-person sample of Greek urban population.

Gender and pain

Females are more likely to report pain. Shega and colleagues (2010) reported that pain was negatively correlated with being a male using 5,549 older adults. Stranjalis and colleagues (2011) reported that female was significantly associated with the presence of neck pain using 1,000 Greek urban population.

Marital status and pain

The relationship between married status and pain is equivocal. Shega and colleagues (2010) reported that pain was negatively correlated with being married using 5,549 older adults. In contrast, Stranjalis and colleagues (2011) reported that being married was significantly associated with the presence of neck pain among 1,000 Greek urban population.

Education and pain

Higher education is negatively associated with pain report. Shega and colleagues (2010) reported that pain was negatively correlated with highest level of education among 5,549 older adults.

Ethnicity and pain

The relationship between ethnicity and pain is inconclusive. Horgas and colleagues (2008) reported that Blacks and Whites did not differ significantly in intensity (t = -1.14, df = 44, p = .26) or duration of self-reported pain (chi-square = 3.68, df = 3, p = .30), or in the number of pain locations reported (t = -1.12, df = 67, p = .23) among 115 older adults. Golightly and Cominick (2005) reported that African Americans with osteoarthritis reported more severe pain than Caucasians among 202 African American and Caucasian veterans. Teno and colleagues (2004) reported that African Americans were 25% less likely to report daily excruciating pain using 2,138,442 MDS assessment data in the U.S. which were completed around April 1999. Rahim-Williams and colleagues (2007) reported that African American and Hispanic subjects showed lower pain tolerances than non-Hispanic White Americans in 63 African American, 61 Hispanic and 82 non-Hispanic white participants. Green and colleagues (2003) reported that racial and ethnic minorities tend to be undertreated for pain when compared with non-Hispanic Whites using a selective literature review performed by experts in pain. Riley and colleagues (2002) reported that African American patients reported significantly higher levels of pain unpleasantness, emotional response to pain, and pain behavior, but not pain intensity than Caucasians using 1084 Caucasian and 473 African American with chronic pain.

Summary

Among 10 background factors, five background factors (e.g., comorbidity, pressure ulcer, number of medications, ADL impairments, and female gender) are positively associated with pain. Cognitive impairments and education level are negatively correlated with pain report. The relationship the other background factors (e.g., age, marital status, and ethnicity) and pain is reported to be equivocal.

Summary

The review of the literature supports the need for and importance for further study on the relationship between pain and disruptive behaviors in PWDs. First, the one published article regarding between pain and wandering (Kiely, et al., 2000) has limited findings due to inappropriate pain measurement and sample. Pain was measured using a sad or painful expression. The painful expression can be considered a valid pain indicator, but confounding the expression of pain with expression of sadness may not be a valid measurement of pain. The authors did not report the reliability or validity of a sad or pained expression as a measurement of pain, and sadness is not the same concept as pain. Also, they used data from all NH residents, without controlling for cognitive status. Not all NH residents expressed pain via wandering. Wandering behavior was observed mainly in NH residents with dementia. So, a study of the relationship between pain and wandering using the appropriate pain measurement and sample, in this case NH residents with dementia, is needed.

Second, there are two studies on the relationship between pain and aggression (Leonard, et al., 2006; Volicer, et al., 2009), but their findings are also limited. Leonard and colleagues measured pain using only pain intensity and aggression frequency by means of a single MDS aggression item, and used data from all NH residents, not just NH residents with dementia. Volicer and colleagues measured pain using only pain frequency and aggression frequency by means of a single MDS aggression item, and recruited Dutch Nursing Home residents with dementia. Comprehensive pain measurements using both pain frequency and pain intensity have better psychometric evidences than either MDS-pain frequency or intensity item. Also, the newly-developed comprehensive MDS-ABS (Perlman & Hirdes, 2008) has better psychometric evidence compared to a single MDS item for measuring aggression. A study on the relationship between pain and aggression using appropriate measurement and involving U.S. Nursing Home residents with dementia is needed.

Third, only two studies (Buffum, et al., 2001; Manfredi, et al., 2003) reported a significant relationship between pain and agitation in Nursing Home residents with dementia. The other studies used all NH residents (not NH residents with dementia) or NH residents in other countries. However, even these two studies used small sample sizes (N = 13 and 33). A small sample size limits the generalizability of the findings (Polit & Beck, 2004). A study using large sample is needed to validate these findings. By using the MDS-CBP agitation subscale (Gerritsen, et al., 2008), one gains access to state- or nation-wide large samples of federally mandated MDS assessment data. A large sample size will be used in this study.

Fourth, none of these published studies regarding the relationship between pain and disruptive behaviors controlled for the use of physical or chemical restraint. Residents with restraints cannot display disruptive behaviors in the same way. In particular, restrained residents cannot wander. Therefore, acquiring more accurate estimates of disruptive behaviors requires controlling for restraint use.

Fifth, studies on the relationship between pain and wandering or aggression used a binary logistic regression for multivariate analysis. The published studies on the relationship between pain and wandering would present more meaningful results if an ordinal logistic regression analysis, rather than binary logistic regression, were used for multivariate analysis, because the levels of measurement for wandering and agitation are ordinal.

Sixth, the high cost of care for the cognitively-impaired, especially in nursing homes, also supports the need to study the relationship between pain and disruptive behaviors in NH residents with dementia. The cost of caring for PWDs in nursing homes is much higher than that of their cognitively intact counterparts (Alzheimer's Association, 2011; National Center for Health Statistics, 2006). One of the reasons for this is the difficulty in the management of disruptive behaviors of NH residents with dementia (Ayalon, et al., 2006; Connor, et al., 2009; Herrmann, 2001; Kutsumi, et al., 2009). If the relationship between pain and disruptive behavior is validated, then appropriate pain management can be utilized to reduce or avert these behaviors and possibly reduce healthcare costs for this population.

Seventh, the lack of definite treatment of disruptive behaviors also supports the need to investigate the relationship between pain and disruptive behaviors. Disruptive behaviors are hard to control because there is no universally effective treatment (Ayalon, et al., 2006; Connor, et al., 2009; Herrmann, 2001; Kutsumi, et al., 2009). Physical and chemical restraints are often used to manage disruptive behaviors. However, restraints of either kind cause significant side effects, and are not recommended as the first choice of intervention. Pain could be a reason for disruptive behaviors in PWDs and pain management could be a solution for addressing the problem.

Finally, the need to investigate this relationship is supported by poor pain management of NH residents with dementia. NH residents with dementia do not get appropriate management of pain (Morrison & Siu, 2000; Reynolds, et al., 2008; Sengupta, et al., 2010). The under-recognition and under-treatment of pain in this population underscore the possibilities of the high prevalence of disruptive behaviors.

Table 2-1. Characteristics of NHs in the United States

Characteristics	NHs	Beds	NH Residents	Number of nursing staff per 100 beds	Number of registered nurses per 100 beds	Number of licensed practical nurses per 100 beds	Number of certified nursing assistants per 100 beds
Total	16,100	1,730,000	1,492,200	917,400 (53)	119,500 (7)	184,600 (11)	600,800 (35)
Type of Ownership							
Proprietary	9,900 (61.5%)	1,074,200	918,000	548,200 (51)	66,200 (6)	114,700 (11)	359,900 (34)
Voluntary nonprofit	5,000 (30.8%)	503,600	440,300	279,200 (55)	40,000 (8)	52,700 (10)	182,500 (36)
Government and other	1,200 (7.7%)	152,200	133,900	89,900 (59)	13,300 (9)	17,200 (11)	58,400 (38)
Number of Beds							
Fewer than 50 beds	2,200 (13.9%)	75,800	62,200	43,600 (58)	6,700 (9)	8,300 (11)	27,900 (37)
50–99 beds	6,000 (37.3%)	454,700	422,600	240,800 (53)	32,300 (7)	47,100 (10)	156,200 (34)
100–199 beds	6,800 (42.5%)	903,100	788,500	478,800 (53)	60,200 (7)	98,600 (11)	314,900 (35)
200 beds or more	1,000 (6.2%)	296,400	218,900	154,300 (52)	20,300 (7)	30,600 (10)	101,900 (34)

Table 2-1. Continued

Characteristics	NHs	Beds	NH Residents	Number of nursing staff per 100 beds	Number of registered nurses per 100 beds	Number of licensed practical nurses per 100 beds	Number of certified nursing assistants per 100 beds
Geographic Region							
Northeast	2,800 (17.4%)	381,500	331,300	214,900 (56)	32,900 (9)	41,700 (11)	138,200 (36)
Midwest	5,300 (33.0%)	526,600	448,000	263,700 (50)	35,200 (7)	49,300 (9)	174,700 (33)
South	5,400 (33.6%)	585,600	501,500	311,100 (53)	33,500 (6)	69,200 (12)	205,000 (35)
West	2,600 (16.0%)	236,200	211,400	127,800 (54)	18,000 (8)	24,400 (10)	82,900 (35)
Location							
Metropolitan statistical area	10,900 (67.7%)	1,290,900	1,127,800	686,900 (53)	91,200 (7)	138,800 (11)	449,400 (35)
Micropolitan statistical area	2,600 (16.2%)	242,200	202,000	129,800 (54)	15,300 (6)	26,900 (11)	84,300 (35)
Other location	2,600 (16.0%)	196,900	162,400	100,700 (51)	13,000 (76)	18,800 (10)	67,100 (34)

Excerpted from National Center for Health statistics 2006 from http://www.cdc.gov/nchs/data/nnhsd/nursinghomefacilities2006.pdf

Table 2-2. Minimum Data Set items

Section number	Section name	Items
Section A.	Identification and background information	Room number, assessment reference date, reentry date, admitted from at entry, marital status, medical record number, payment source for NH stay, reasons for assessment, responsibility/legal guardian, advance directives
Section AA.	Identification information	Resident name, gender, birth date, race/ethnicity, social security number, resident Medicare number or comparable number, facility state number, facility federal number, resident Medicaid number, primary reason for assessment, special assessment code
Section AB.	Demographic information	Date of entry, admitted from at entry, lived alone prior to entry, zip code of prior primary residence, residential history, lifetime occupation, highest level education completed, language, mental health history, condition related to mental retardation, date background information completed
Section AC.	Customary routine	Cycle of daily events, eating patterns, activities of daily living, involvement patterns
Section B.	Cognitive patterns	Comatose, memory, memory/recall ability, cognitive skills for daily decision-making, indicators of delirium, change in cognitive status
Section C.	Communication/ hearing patterns	Hearing, communication devices/techniques, modes of expression, making self understood, speech clarity, ability to understand others, change in communication/hearing
Section D.	Vision patterns	Vision, visual limitation/difficulties, visual appliances
Section E.	Mood and behavior patterns	Indicators of depression or anxiety or sad mood, mood persistence, change in mood, behavioral symptoms, change in behavioral symptoms
Section F.	Psychosocial well-being	Sense of initiative, unsettled relationships, past roles
Section G.	Physical functioning and structural problems	Activities of daily living (ADLs) self-performance, ADL support, bathing, test for balance, functional limitation in range of motion, modes of locomotion, modes of transfer, task segmentation, ADL functional rehabilitation potential, change in ADL function
Section H.	Continence in last 14 days	Continence self-control, bowel elimination patterns, appliances and programs, change in urinary continence
Section I.	Disease diagnoses	Diseases, infection
Section J.	Health conditions	Problem conditions, pain symptoms, pain site, accidents, stability of conditions

Table 2-2. Continued

Section number	Section name	Items
Section K.	Oral/nutritional status	Oral problems, height and weight, weight change, nutritional problems, nutritional approaches, parental or enteral intake
Section L.	Oral/dental Status	Oral status and disease prevention
Section M.	Skin condition	Ulcer, type of ulcer, history of resolved ulcers, other skin problems or lesions present, skin treatments, foot problems and care
Section N.	Activity pursuit patterns	Time awake, average time involved in activities, preferred activity settings, general activity preferences, prefers change in daily routine
Section O.	Medications	Number of medications, new medications, injections, days received the medications
Section P.	Special treatment and procedures	Special treatments or programs, intervention programs for mood or behavior, nursing rehabilitation/restorative care, devices and restraints, hospital days, emergency room visits, physician visits, physician orders, abnormal lab values
Section Q.	Discharge potential and overall status	Discharge potential, overall change in care needs
Section R.	Assessment information	Participation in assessment, discharge disposition
Section T.	Supplement - special treatments and procedures	Special treatments and procedures, walking when most self confident,
Section V.	Resident Assessment Protocol (RAP) Summary	Location and date of RAP assessment documentation
Section W.	Additional items collected	Influenza and pneumococcal vaccination

Table 2-3. Summary of psychometric properties on published MDS 2.0 items or scales on pain, cognition, and behavior

Source	Number of residents	Number of NHs	Validity	Reliability
MDS-Pain				
(Fries, et al., 2001)	95	25	Criterion validity: 0.70 against Visual Analogue Scale	Inter-rater reliability coefficient of 0.73
(Cohen-Mansfield, et al., 1999)	80	8		Cronbach's alpha coefficient of 0.69 – 0.88
(Fisher, et al., 2002)	57	3	No significant relationship with Proxy Pain Questionnaire developed by researchers	Test-retest reliability coefficient of 0.84 – 0.87
MDS-Cognitive Performance Scale (MDS-CPS)				
(Bula & Wietlisbach, 2009)	401		Criterion validity: 0.52 against MMSE	
(Morris, et al., 1994)	2,172		Criterion validity: high against MMSE and Test for Severe Impairment, Construct validity: reflected two different samples	Test-retest reliability: high
(Hartmaier, et al., 1994)	200	8	Criterion validity: 0.41 – 0.76 against Global Deterioration Scale, high against MMSE	
(Gruber-Baldini, Zimmerman, Mortimore, & Magaziner, 2000)	1,939	59	Criterion validity: 0.68 against MMSE, 0.66 against Psychogeriatric Dependency Rating Scale, Orientation Scale	
(Cohen-Mansfield, et al., 1999)	290	1	Criterion validity: 0.71 – 0.75 against MMSE, 0.75 – 0.77 against Global Deterioration Scale	
(Snowden, et al., 1999)	140		Criterion validity: 0.45 against MMSE	
(Lawton, et al., 1998)			Criterion validity: 0.45 against Mattis Dementia Rating Scale, 0.7 against Global Deterioration Scale	
(Horgas & Margrett, 2001)	135	1	Criterion validity: Significant for nondepressed sample, but not for depressed sample against RMBPC	

Table 2-3. Continued

Source	Number of residents	Number of NHs	Validity	Reliability
MDS-Activities of Daily Living				
(Lawton, et al., 1998)	513	1	Criterion validity: 0.58 – 0.79 against Physical Self-Maintenance Scale	Reliability coefficient of 0.97, kappa coefficient of 0.61
(Hawes, et al., 1995)	123	13		Reliability coefficient of 0.92
(Sgadari, et al., 1997)	123	13		Reliability coefficient of 0.92
MDS-wandering				
(Casten, et al., 1998)				Inter-rater reliability coefficient of 0.95
(Sgadari, et al., 1997)	123	13		Reliability coefficient of 0.63
(Lawton, et al., 1998)			Criterion validity: 0.51-0.54	
MDS-Aggression Behavior Scale				
(Perlman & Hirdes, 2008)	652	4	Criterion validity: 0.72 with Cohen-Mansfield Agitation Inventory aggression subscale scores	Cronbach's alpha coefficient of 0.79 to 0.95
MDS-Agitation Scale				
(Gerritsen, et al., 2008)	656	4	Criterion validity: Spearman's rank correlation coefficient of 0.50 with Behavior Rating Scale for Psychogeriatric Inpatients	Cronbach's alpha coefficient of 0.70, inter-rater reliability of 0.61

Note: MMSE: Mini-Mental State Examination; NH: nursing home; RMBPC: Revised Memory and Behavior Problem Checklist. The detailed reliability and validity coefficients for this study items will be described in the Chapter 3.

Table 2-4. Literature regarding the relationship between pain and disruptive behaviors in facility-dwelling older adults

Source	Sample/setting/study period	Findings
Pain and Wandering		
(Kiely, et al., 2000)	8,982 NH residents from Mississippi, Texas, and Vermont on MDS assessment data between January, 1996 and December, 1997	NH residents who expressed sadness or pain in MDS assessment data were 65% more likely to develop wandering behavior than their counterparts who did not express sadness or pain in MDS data using a logistic regression analysis, after controlling for pneumonia, short-term memory, repetitive questions, long-term memory, constipation, antipsychotic medication, ADL impairment, and gender, OR = 1.65, $p = .02$, 95% CI [1.08, 2.53].
Pain and aggression		
(Volicer, et al., 2009)	MDS assessment data of 929 residents with dementia from 8 Dutch nursing homes and 10 residential homes between April 4, 2007 and December 1, 2008	Pain frequency was significantly correlated with frequency of verbal aggression using MDS assessment data in a bivariate correlation analysis ($r = .07$, $p = .028$). In a multivariate analysis, pain frequency was not significantly associated with frequency of aggression, after controlling for hallucinations, delusions, ability to understand others, depression, and constipation.
(Leonard, et al., 2006)	103,344 NH residents in 5 states who had at least one annual MDS assessment data completed during 2002	Pain intensity was not significantly associated with frequency of physical aggression using MDS assessment data in a multivariate logistic regression analysis, after controlling for depression, delusions, hallucinations, constipation, respiratory tract infection, urinary tract infection, fever, and the amount of time participating in non-ADL or treatment activities such as recreational activities.
Pain and agitation		
(Buffum, et al., 2001)	33 Veterans Affairs NH residents with dementia from one Veterans Affairs Medical Center, unknown study period	Pain severity measured by a discomfort scale was significantly associated with the presence of agitation, as measured by modified Cohen-Mansfield Agitation Inventory ($r = .50$, $p = .003$).
(Manfredi, et al., 2003)	13 NH residents with dementia in one nursing home who were more than 85 years old, conducted from January 1999 to January 2001	Low dose, long-acting opioid treatment reduced the frequency of agitation measured by the CMAI using a prospective longitudinal design over 4-weeks, mean change in CMAI score: -6.4, 95% CI [-10.96, -1.8].

Table 2-4. Continued

Source	Sample/setting	Findings
(Villanueva, et al., 2003)	40 residents from four long-term care facilities, three skilled nursing facilities, and a locked dementia assisted-living facility, unknown study period	Pain measured by the pain assessment for the dementing elderly (PADE) was significantly associated with frequency of agitation as measured by the CMAI. The physical assessment section of PADE correlates significantly with the CMAI verbal agitation subscale (r = .296, p < 0.01), and the global assessment section of PADE is significantly associated with physically aggressive, verbal and physical agitation subscales of the CMAI (r = 0.396, r = 0.398, r = 0.421, respectively; p < .01).
(Bartels, et al., 2003)	2,487 physically frail older residents from 109 long-term care facilities, unknown study period	The prevalence of pain was significantly associated with mixed agitation and depression in NH residents with dementia by documentation on the medical record. Thirty-four percent of PWDs with mixed agitation and depression exhibited pain, whereas only 23% of uncomplicated PWDs exhibited pain, chi-square=36.20, p < .0001.
(Norton, et al., 2010)	169 residents from 10 NHs in Birmingham, Alabama, unknown study period	Certified nursing assistant (CNA)-reported weekly resident pain intensity were significantly associated with disruptive behaviors as measured by subscales within the Revised Memory and Behavior Problem Checklist-Nursing Home (RMBPC-NH) in a multiple regression analysis, after controlling for cognitive impairments, gender, ethnicity, and ADL functional status (β = .183, p = 0.04). The number of painful diagnoses and analgesic medication administration by the chart review was not significantly associated with disruptive behaviors as measured by subscales within the RMBPC-NH.

CHAPTER 3
METHODS

Design

This is a secondary analysis of the Minimum Data Set (MDS 2.0) assessment data on long-term care from the state of Florida. An exploratory cross-sectional design is used for this study. Cross-sectional data, the first MDS comprehensive assessment data for each NH residents during the 12-month time frame, are used to explore the relationship between pain and disruptive behaviors.

Sample

Participants in this study are residents with dementia in Medicare- or Medicaid-certified NHs in the state of Florida between January 1, 2009 and December 31, 2009 who have a MDS comprehensive assessment on file. The MDS comprehensive assessment data are used for this study because this is the only version of the MDS that includes all the needed variables. These are shortened assessment data that do not include some variables for this study, such as complaints of hunger (MDS item # K4B), diseases (MDS item # I1), infection (MDS item # I2), other diagnoses (MDS item # I3), and education (MDS item # AB7), and therefore are excluded.

MDS assessment data from Florida NHs are acquired from the Centers for Medicare & Medicaid Services (CMS). All of the U.S. nursing home MDS assessment is collected quarterly by CMS, and is stored in American Standard Code for Information Interchange (ASCII) format text file. The Research Data Assistance Center (ResDAC), based at the University of Minnesota, is the data coordinating agency that pre-reviews proposals for MDS use and helps distribute MDS data from CMS to researchers. There is a fee for its use ($ 1,000/state/year).

CMS stipulated that the MDS data users should: ensure that data will be used only for the specified purposes in the data use agreement; submit the executive summary which states the data management plan and lists the key personnel of the study being proposed; submit the study protocol which includes background and importance, research questions and methods, analysis plan and schedule; plan on implementing safeguards to prevent unauthorized use of data; return or destroy data by a specified date; and not release information that would permit the identification of the subjects (Research Data Assistance Center [ResDAC], 2010).

Selection criteria are applied to ascertain data from NH residents older than 65 years old (MDS item # AA3) with Alzheimer' disease or other dementia (MDS item # I1Q = yes or # I1U = yes). Data from comatose residents (MDS item # B1 = 1) are excluded. Also, the statistical analyses for NH residents without restraints are reported separately because residents with restraints cannot exhibit disruptive behaviors.

Proposed Measures

Measures, operational definitions and the interpretations of each measure are summarized in Table 3-1.

Pain

The MDS-pain severity scale (Fries, et al., 2001), combining both pain frequency and pain intensity (MDS item # J2A and J2B, respectively), is used to assess pain severity in NH residents with dementia. MDS-pain severity scale (Fries, et al., 2001) is recorded on a 4-point ordinal scale, 0 (*no pain*), 1 (*mild pain*), 2 (*moderate pain*), and 3 (*excruciating pain*). Mild pain accounts for pain which is less than daily in MDS-pain frequency. Moderate pain accounts for daily pain in MDS-pain frequency and mild or moderate pain in MDS-pain intensity. Excruciating pain accounts for daily pain in MDS-pain frequency and horrible or excruciating pain in MDS-pain intensity. MDS-pain items (frequency and intensity) code the highest level of pain present in the last seven days. Pain frequency is recorded on a three-point ordinal scale, with 0 (*no pain*), 1 (*pain less than daily*), and 2 (*pain daily*). Pain intensity is also coded on a three-point ordinal scale, with 1 (*mild pain*), 2 (*moderate pain*), and 3 (*horrible or excruciating pain*). NH residents' self report is reflected in the MDS pain items if residents can self-report and staff completing MDS assessments have confidence with residents' self-report. Otherwise, the staff who complete the MDS assessment document pain symptoms based on reports from facility nursing staff that takes care of the residents. The MDS-pain severity scale has been reported to have an inter-rater reliability coefficient of 0.73 and higher, and kappa coefficient of 0.70 with a Visual Analogue Scale in a study involving 95 U.S. nursing home residents at 25 Medicare-certified skilled nursing facilities in Massachusetts (Fries, et al., 2001). The original MDS-pain intensity and frequency is reported to have an internal consistency of 0.69-0.88 and test-retest reliability of 0.84-0.87 (Cohen-Mansfield, et al., 1999; Fisher, et al., 2002).

Secondary Proximal Factors

The measurements of secondary proximal factors (e.g., hunger, thirst, and elimination) are described below.

Hunger

The MDS-hunger item (MDS item # K4B) is used to assess PWDs' regular or repetitive complaints of hunger by a dichotomized variable, with 0 (*no*) and 1 (*yes*). The MDS-hunger item has a reliability coefficient of 0.69 (Hawes, et al., 1995).

Thirst

The MDS-dehydration status (MDS item # J1C) is used to assess PWDs' thirst. It is recorded on a dichotomous scale, 0 (no) and 1 (yes). The MDS-dehydration item has a reliability coefficient of 0.49 (Hawes, et al., 1995).

Elimination

The MDS-bowel incontinence and bladder incontinence items (MDS item # H1A and H1B) are used to assess PWDs' elimination status. It is recorded on a 5-point ordinal scale, with

0 (*continent*), 1 (*usually continent*), 2 (*occasionally incontinent*), 3 (*frequently incontinent*), and 4 (*incontinent*). The MDS-continence items have a reliability coefficient of 0.91 to 0.99, and an inter-rater reliability coefficient of 0.61 (Casten, et al., 1998; Hawes, et al., 1995).

Background Factors

The measurements of the background factors (e.g., neurocognitive factor, comorbidity, pressure ulcer, medication, ADL impairments, and sociodemographics) are described below.

Neurocognitive factor

The MDS-cognitive performance scale (MDS-CPS) (Morris, et al., 1994) is used to measure memory and cognition. It is a 7-point ordinal scale, with 0 (*intact*), 1 (*borderline intact*), 2 (*mild impairment*), 3 (*moderate impairment*), 4 (*moderate severe impairment*), 5 (*severe impairment*), and 6 (*very severe impairment*) (Carpenter, et al., 2006; McConnell, Branch, Sloane, & Pieper, 2003; McConnell, et al., 2002).

The MDS-CPS score is calculated using five MDS items: comatose (MDS item # B1), short-term memory (MDS item # B2A), cognitive skills or daily decision making (MDS item # B4), making oneself understood (MDS item # C4), and self-performance in eating (MDS item # G1HA). Comatose (MDS item # B1) is recorded dichotomously (0 = *no*, 1 = *yes*). Short-term memory (MDS item # B2A) is recorded dichotomously (0 = *memory OK*, 1 = *memory problematic*). Cognitive skills or daily decision making (MDS item # B4) is recorded 4-point ordinal scale, with 0 (*independent*), 1 (*modified independence*), 2 (*moderately impaired*), and 3 (*severely impaired*). Making oneself understood (MDS item # C4) is recorded 4-point ordinal scale, with 0 (*understood*), 1(*usually understood*), 2 (*sometimes understood*), and 3 (*rarely or never understood*). Self-performance in eating (MDS item # G1HA) is recorded 5-point ordinal scale, with 0 (*independent*), 1 (*supervision*), 2 (*limited assistance*), 3 (*extensive assistance*), and 4 (*total dependence*).

The MDS-CPS is widely used in research, and has high test-retest reliability, a criterion validity coefficient of 0.45-0.75 with Mini-Mental State Examination, a criterion validity coefficient of 0.41-0.77 against Global Deterioration Scale, a criterion validity coefficient of 0.66 against Psychogeriatric Dependency Rating Scale, a criterion validity coefficient of 0.45 against Mattis Dementia Rating Scale, a sensitivity of 0.94, and a specificity of 0.94 (Bula & Wietlisbach, 2009; Cohen-Mansfield, et al., 1999; Gruber-Baldini, et al., 2000; Hartmaier, et al., 1994; Hartmaier, et al., 1995; Lawton, et al., 1998; McConnell, et al., 2003; McConnell, et al., 2002; Morris, et al., 1994; Snowden, et al., 1999).

Comorbidity

The Charlson comorbidity index (CCI) (Charlson, Pompei, Ales, & MacKenzie, 1987) is used to assess comorbidity using MDS-disease, infections, and other diagnoses (MDS item # I1, I2, I3, respectively). The CCI is widely used in research (Diederichs, Berger, & Bartels, 2011; Norton, et al., 2010), and has acceptable reliability and validity (Charlson, Szatrowski, Peterson, & Gold, 1994). This index is a sum score of 19 weighted categories of comorbidity to assess the impact of comorbid diseases on one year mortality using a medical chart review. The CCI ranges 0 to 37, with higher scores indicating greater comorbidity. Weighting of clinical conditions for Charlson Comorbidity Index is presented in Table 3-2.

Weight one is assigned for myocardial infarct, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, connective tissue disease, ulcer disease, mild liver disease, diabetes; Weight two is assigned for hemiplegia, moderate or severe renal disease, diabetes with end organ damage, any tumor, leukemia, lymphoma; Weight three is assigned for moderate or severe liver disease; Weight six is assigned for metastatic solid tumor and AIDS.

Among 19 diseases for the Charles comorbidity index, 13 diseases are counted in the MDS-disease or infection item (MDS item # I1, I2, respectively):

- myocardial infarct (MDS item # I1D)
- congestive heart failure (MDS item # I1F)
- peripheral vascular disease (MDS item # I1J)
- cerebrovascular disease (MDS item # I1T)
- dementia (MDS item # I1Q or I1U)
- chronic pulmonary disease (MDS item # I1II)
- diabetes (MDS item # I1A)
- hemiplegia (MDS item # I1V)
- moderate or severe renal disease (MDS item # I1QQ)
- diabetes with end organ damage (MDS item # I1KK)
- tumors (MDS item # I1PP)
- mild chronic liver disease or cirrhosis (MDS item # I2K)
- AIDS (MDS item # I2D)

Each disease is recorded by dichotomized variable, with 0 (*no*) and 1 (*yes*). However, six diseases are identified using ICD-9 codes in the MDS-other diagnoses (MDS item # I3): connective tissue disease (ICD-9 code #7100, 7101, 7104, 7140, 7141, 7142, 71481, 5171, and 725), peptic ulcer disease (ICD-9 code #531, 532, 533, and 534), leukemia (ICD-9 code #204, 205, 206, 207, and 208), lymphoma (ICD-9 code # 200, 201, and 202), moderate or severe liver disease (ICD-9 code #5722, 5723, 5724, and 5728), and metastatic solid tumor (ICD-9 code #196, 197, 198, 1990, and 1991).The MDS-disease/infection item has a reliability coefficient of 0.74 (Hawes, et al., 1995).

Pressure ulcer

MDS-pressure ulcer (MDS item # M2) is also used to assess PWDs' pressure ulcer. MDS-pressure ulcer is a 5-point ordinal scale, 0 (none) to 4 (stage 4), and has been reported to have a reliability coefficient of 0.62 (Hawes, et al., 1995)

Medication

The number of medications (MDS item # O1) is recorded by its actual number of different medications used in the last 7 days. The MDS-medication items have a reliability coefficient of 0.73 (Hawes, et al., 1995).

Activities of daily living

MDS-Activities of Daily Living-Long Form (MDS ADL-Long Form) (Morris, Fries, & Morris, 1999) is used to measure ADL levels of each resident. MDS ADL-Long Form is calculated using 7 MDS items: self-performance of bed mobility (MDS item # G1AA), transfer (MDS item # G1BA), locomotion on unit (MDS item # G1EA), dressing (MDS item # G1GA), eating (MDS item # G1HA), toile use (MDS item # G1IA), and personal hygiene (MDS item # G1JA). Each of these individual items is recorded on a 6-point ordinal scale, with 0 (*independent*), 1 (*supervision*), 2 (*limited assistance*), 3 (*extensive assistance*), 4 (*total dependence*), and 8(*activity did not occur during last 7 days*). The MDS ADL-Long Form scores are calculated by summing these 7 items after changing a response of the "activity did not occur during last 7 days" into "total dependence (Morris, et al., 1999)". MDS ADL-Long Form can range from 0 to 28, with higher scores indicating more dependence of ADLs. The MDS ADL-Long Form is widely used in research, and has been reported to have a reliability coefficient of 0.92-0.97, an inter-rater reliability coefficient of 0.61-0.95, and a criterion validity coefficient of 0.58 – 0.79 against Physical Self-Maintenance Scale (Hawes, et al., 1995; Lawton, et al., 1998; Sgadari, et al., 1997)

Sociodemographics

Age (MDS item # AA3), gender (MDS item # AA2), marital status (MDS item # A5), education (MDS item # AB7), and race/ethnicity (MDS item # AA4) are captured from MDS assessment data.

Disruptive Behaviors

The measurements of disruptive behaviors (e.g., wandering, aggression, and agitation) are described as follows.

Wandering

MDS-wandering frequency item (MDS item # E4A) is used to measure the frequency of wandering. Wandering frequency is recorded by staff observation of the frequency of movement with no rational purpose in the last 7 days. It is recorded on a 4-point ordinal scale, with 0 (*no wandering*), 1 (*wandering occurred 1 to 3 days in last 7 days*), 2 (*wandering occurred 4 to 6 days in last 7 days*), and 3 (*wandering daily*). The wandering item has been reported to have a reliability coefficient of 0.63, an inter-rater reliability of 0.95, and a concurrent validity of 0.51 to 0.54 (Casten, et al., 1998; Hawes, et al., 1995; Lawton, et al., 1998; Sgadari, et al., 1997).

Aggression

The MDS-Aggression behavior scale (MDS-ABS) is used to measure the frequency of aggressive behaviors. MDS-ABS is a sum score of four MDS items: verbally abusive behavioral symptoms (MDS item # E4BA), physically abusive behavioral symptoms (MDS item # E4CA), socially inappropriate/disruptive behavioral symptoms (MDS item # E4DA), and resisting care (MDS item # E4EA). Each of these individual items are recorded the frequency of these behavioral symptoms in last 7 days on a 4-point ordinal scale, with 0 (*no symptoms*), 1 (*symptoms occurred 1 to 3 days in last 7 days*), 2 (*symptoms occurred 4 to 6 days in last 7 days*), and 3 (*symptoms daily*). MDS-ABS can range from 0 to 12, with higher scores indicating more frequency of aggressive behaviors. If needed, aggressive behaviors (MDS-ABS scores) can be collapsed into four groups for statistical analysis, none (MDS-ABS = 0), moderate (MDS-ABS = 1 - 2), severe (MDS-ABS = 3 - 5), and very severe (ABS= 6 - 12), based on an established algorithm (Perlman & Hirdes, 2008). The MDS-ABS has been reported to have an internal consistency reliability of 0.79 to 0.95, and a criterion validity coefficient of 0.72 with CMAI aggression subscale scores (Perlman & Hirdes, 2008).

Agitation

The MDS-Challenging Behavior Profile (MDS-CBP) agitation subscale is used to assess the frequency of agitated behaviors. MDS-CBP-agitation scores are calculated using four MDS items: periods of restlessness (MDS item # B5D), repetitive physical movements (MDS item # E1N), wandering (MDS item # E4AA), and socially inappropriate/disruptive behavior (MDS item # E4DA). Periods of restlessness (MDS item # B5D) is recorded the frequency of this behavioral symptom by 3-point ordinal scale, with 0 (behavior not present), 1 (behavior present, not of recent onset), and 2 (new onset or worsening behavior). Repetitive physical movements (MDS item # E1N) is recorded the frequency of this behavioral symptom in last 7 days by 3-point ordinal scale, with 0 (behavior not exhibited in last 30 days), 1 (behavior exhibited up to five days a week), and 2 (behavior exhibited daily or almost daily). Wandering (MDS item # E4AA) and socially inappropriate behavior (MDS item # E4DA) are recorded the frequency of these behavioral symptoms in last 7 days by 4-point ordinal scale, with 0 (*no behavior exhibition*), 1 (*behavior occurred 1 to 3 days in last 7 days*), 2 (*behavior occurred 4 to 6 days in last 7 days*), and 3 (*behavior daily*).

The MDS-CBP-agitation scores are calculated by summing these four items after the scale of three items are changed. Periods of restlessness (MDS item # B5D) is modified from 3-point scale (0 to 2) to 2-point scale (0 and 1). Wandering (MDS item # E4AA) and socially inappropriate/disruptive behavior (MDS item # E4DA) are modified from 4-point scale (0 to 3) to 3-point scale (0 to 2). MDS-CBP-agitation can range from 0 to 7, with higher scores indicating more frequency of agitated behaviors.

MDS-CBP agitation subscale has been reported to have an internal consistency reliability of 0.70, inter-rater reliability of 0.61, and a Spearman's rank correlation coefficient of 0.50 with Behavior Rating Scale for Psychogeriatric Inpatients (Gerritsen, et al., 2008). The overall MDS-CBP has an internal consistency reliability of 0.54 to 0.78, inter-rater reliability of 0.53 (Gerritsen, et al., 2008).

Procedures

Approval for the study is obtained from the University of Florida Health Science Center Institutional Review Board. The researcher worked with the Research Data Assistance Center (ResDAC) to obtain the Florida 2009 MDS data from the Centers for Medicare & Medicaid Services (CMS). Subject records are assigned an identification number, and no personal identification information, such as name, address and social security number, are obtained from CMS. Once obtained, the MDS assessment dataset are stored on network storage drives at the University of Florida Health Science Center, accessible only with a password via an encrypted desktop computer.

Data Analysis

The ASCII format MDS text file is reformatted to a SPSS data file. The SPSS program is used for storing the database file, analyzing the data, and computing the statistical tests in this study. Results are considered statistically significant with a *p*-value of less than 0.05.

First aim. To describe the prevalence of disruptive behaviors in NH residents with dementia. 1A) To describe the prevalence of wandering behaviors as measured by MDS-wandering frequency in NH residents with dementia. 1B) To describe the prevalence of aggressive behaviors as measured by MDS-Aggression Behavior Scale (MDS-ABS) in NH residents with dementia. 1C) To describe the prevalence of agitated behaviors as measured by

MDS-Challenging Behavior Profile (MDS-CBP) agitation subscale in NH residents with dementia.

MDS-wandering frequency is recorded as an ordinal form, with 0 (*no wandering*), 1 (*wandering occurred 1-3 days in last 7 days*), 2 (*wandering occurred 4-6 days in last 7 days*), and 3 (*wandering daily*). Frequency data are presented with a number and percentage for wandering behaviors in NH residents with dementia.

MDS-ABS is recorded as a continuous form, ranging from 0 to 12, with higher scores indicating more frequency of aggressive behaviors. MDS-CBP agitation subscale is recorded as a continuous variable, ranging from 0 to 7, with higher scores indicating more frequency of agitated behaviors. Descriptive statistics, including means, standard deviations, and ranges, are presented for aggression and agitation in NH residents with dementia.

Second aim. To investigate the effect of pain severity on the frequency of disruptive behaviors in NH residents with dementia, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence). 2A) To investigate the effect of pain severity on the frequency of wandering behaviors as measured by MDS-wandering frequency in NH residents with dementia, after controlling for the other background/proximal factors. 2B) To investigate the effect of pain severity on the frequency of aggressive behaviors as measured by MDS-Aggression Behavior Scale (MDS-ABS) in NH residents with dementia, after controlling for the other background/proximal factors. 2C) To investigate the effect of pain severity on the frequency of agitated behaviors as measured by MDS-challenging behavior profile (MDS-CBP) agitation subscale in NH residents with dementia, after controlling for the other background/proximal factors.

Hypothesis for the second aim. Among NH residents with dementia, pain severity will be significantly associated with increased frequency of disruptive behaviors, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence). 2A) Among NH residents with dementia, pain severity will be significantly associated with increased frequency of wandering behaviors as measured by MDS-wandering frequency, after controlling for the other background/proximal factors. 2B) Among NH residents with dementia, pain severity will be significantly associated with increased frequency of aggressive behaviors as measured by MDS-ABS, after controlling for the other background/proximal factors. 2C) Among NH residents with dementia, pain severity will be significantly associated with increased frequency of agitated behaviors as measured by MDS-CBP agitation subscale, after controlling for the other background/proximal factors.

Univariate and bivariate analyses are conducted first. Descriptive data are presented, including means, standard deviations, and ranges for continuous variables. Frequency data, such as number and percentage, are presented for categorical variables. Bivariate analyses are conducted based on the functional form of variables using independent t-test, one-way independent ANOVA, Pearson correlation, Mann-Whitney U test (nonparametric version of independent t-test), Kruskal-Wallis test (nonparametric version of one-way independent ANOVA), or Spearman's correlation (nonparametric version of Pearson correlation). Functional forms of variable are summarized in the Table 3-3.

Multivariate analyses are conducted based on the functional form of the dependent variables. First, multiple ordinal least squares regression analysis is used to evaluate the effect of pain on aggression and agitation, because MDS-ABS and MDS-CBP agitation subscales are recorded as continuous forms, with higher scores indicating more aggressive and agitated behaviors. Among several kinds of multiple regression, hierarchical multiple regression analysis is used because it is the statistical method to control covariates based on the theoretical model (Field, 2005; Polit, 2010). Covariates are entered first, and the most important independent variable are entered last. For this study, pain severity score is entered in block 2, after the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence) are entered in block 1.

Nominal independent variables are recoded into dummy variables before executing multiple regression analyses. If ordinal independent variables have sufficient categories, the distributions are reasonably close to being normal distribution, and have a linear relationship with other variables, then ordinal variables are used without recoding into dummy variables. Otherwise, ordinal independent variables are also recoded into dummy variables.

Influential outliers are identified. Influential outliers that can have a strong impact on the regression solution are diagnosed and addressed. To detect outliers and influential cases, standardized residuals of regression model and DfBeta in SPSS output table are examined. Standardized residuals greater than 1.96 are determined as outliers, and among these outliers, influential cases whose DfBetas greater than one are addressed (Field, 2005).

Multicollinearity is a problem that can occur when independent variables are highly intercorrelated, and can yield misleading regression results. To detect multicollinearity, the collinearity statistics are also examined. In the multicollinearity evaluation step, a variance inflation factor (VIF) less than 10 can be assumed to have no multicollinearity (Field, 2005). If the VIF value is greater than 10, a collinearity diagnostic table will be generated and examined to detect problematic variable from model. Variables whose variance proportions are greater than 0.5 can be considered as problematic variable, and these variables are deleted except one variable from the model and regression will be rerun.

After identifying influential outliers and multicollinearity, the assumptions of multiple regression analysis are examined: (a) linear relationship between continuous variables through scatterplot, null plot, and partial plot, (b) normality of the error term through histogram of residuals and Shapiro-Wilk test, (c) constant variance of the error (homoscedeaticity) through null plot, and (d) independence of the error terms through Durbin-Watson test. The linear relationship, not curvillinearity, is checked using scatter plots, null plots, and partial plots, if independent variables are metric. Histogram of standardized residuals and a Shapiro-Wilk test are conducted to check the normality of error terms. If the *p*-value of the Shapiro-Wilk test is greater than .05, normal distribution will be assumed. The homoscadesiticity, constant variance of the error, is examined by a null plot. Null plot will be expected to have equal variance across all predicted values and no pattern of increasing or decreasing residuals. The independence of the error terms is checked by the Durbin-Watson test. The Durbin-Watson test of two represents independence of error terms and being close to 0 or 4 represents dependence of error terms.

After checking assumptions, hierarchical multiple regression analysis is used to estimate the adjusted R square and to calculate the F ratio, and the *p*-value is used as the test of statistical significance. Also, information on the changes to R^2 and the significance of the changes are presented. The adjusted R^2 refers to amount of variance in the dependent variable that is accounted for by the independent variables. F ratio and *p*-value refers to the statistical significance of the model. Standardized beta refers to strength and direction of the relationship between independent variable and dependent variable, and indicates the number of units by standard deviation that the DV is expected to change for one standard deviation change in a predictor when the effects of all other predictors are held constant.

Second, ordinal logistic regression analysis is used to evaluate the effect of pain on wandering, because MDS-wandering frequency is recorded as an ordinal variable. Before conducting ordinal logistic regression, the assumptions for ordinal logistic regression are evaluated (empty cells between categorical variables, influential outliers and multicollinearity). Empty or small cells are checked by executing a crosstab between categorical independent variables and the dependent variables. Influential outliers and multicollinearity that can have a strong impact on the regression solution are diagnosed and addressed. After evaluating the assumptions for logistic regression analysis, ordinal logistic regression analysis is interpreted, using the -2 log likelihood, the Nagelkerke R square, odds ratio, and the *p*-value to identify the statistical significance. First, the statistical significance of the logistic regression model is determined by the -2 log likelihood (-2LL). If -2LL is statistically significant, then the ordinal logistic model is assumed to fit significantly better than null model which is model with no predictors. Then, using the Nagelkerke R square, the variance of the dependent variable will be evaluated to be explained by predictors. The Nagelkerke R square refers to the variance of the dependent variable which can be explained by independent variables, such as R square in a multiple regression analysis. Finally, how the individual coefficients predict the dependent variable will be interpreted using odds ratio and the *p*-value. For every unit increase in predictor, the odds of the being one unit higher in dependent variable will be evaluated by odds ratio.

Third aim. To evaluate whether pain severity mediates the effect of background factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, and ethnicity) on the frequency of disruptive behaviors in NH residents with dementia. 3A) To evaluate whether pain severity mediates the effect of background factors on the frequency of wandering behaviors as measured by MDS-wandering frequency in NH residents with dementia. 3B) To evaluate whether pain severity mediates the effect of background factors on the frequency of aggressive behaviors as measured by MDS-Aggression Behavior Scale (MDS-ABS) in NH residents with dementia. 3C) To evaluate whether pain severity mediates the effect of background factors on the frequency of agitated behaviors as measured by MDS-challenging behavior profile (MDS-CBP) agitation subscale in NH residents with dementia.

Hypothesis for the third aim. Among NH residents with dementia, pain severity will mediate the effect of background factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, and ethnicity) on the frequency of disruptive behaviors. 3A) Among NH residents with dementia, pain severity will mediate the effect of background factor on the frequency of wandering behaviors as measured by MDS-wandering frequency in NH residents with dementia. 3B) Among NH residents with dementia, pain severity will mediate the effect of background factors on the frequency of aggressive behaviors as measured by MDS-Aggression Behavior Scale (MDS-ABS) in NH residents with dementia. 3C) Among NH residents with dementia, pain severity will mediate the effect of background factors on the frequency of agitated behaviors as measured by MDS-challenging behavior profile (MDS-CBP) agitation subscale.

Univariate and bivariate analyses are conducted first. Descriptive data are presented, including means, standard deviations, and ranges for continuous variables. Frequency data, such as number and percentage, are presented for categorical variables. Bivariate analyses are conducted based on the functional form of variables. Functional form of variable is summarized in the Table 3-3.

Path analysis using ordinal logistic regression and multiple regression analysis are executed to evaluate whether pain severity mediates the effect of background factors on the frequency of disruptive behaviors. For analysis of the mediator effect, three regressions analyses are performed. These include (1) the regression between background factor (predictor) and disruptive behavior (outcome); (2) the regression between background factor (predictor) and pain (mediator); and (3) the regression among background factor and pain as independent variables with disruptive behavior as a dependent variable (Baron & Kenny, 1986; Meyers, Gamst, & Guarino, 2006).

In step one, the relationship between background factor (predictor) and disruptive behaviors (outcome) is estimated. If the regression between background factor (predictor) and disruptive behavior (outcome) is statistically significant, then the second step will be taken. In step two, the relationship between background factor (predictor) and pain (mediator) is estimated. If the relationship between background factor (predictor) and pain (mediator) is statistically significant, then the third step will be done. In step three, the regression among background factor and pain (independent variables) and disruptive behaviors (dependent variable) is estimated. If the relationship between background factors (predictor) and disruptive behaviors (outcome) is not statistically significant and the relationship between pain (mediator) and disruptive behaviors (outcome) is significant, the mediator relationship is deemed to exist.

There should be non-significant relationship between background factor (predictor) and disruptive behavior (outcome) when pain (mediator) is in the regression model, if the mediating effect is existed (Bennett, 2000; Holmbeck, 1997).

Fourth aim. To investigate those three aims in the unstrained residents. 4A) To describe the prevalence of disruptive behaviors in the unstrained residents. 4B) To investigate the effect of pain severity on the frequency of disruptive behaviors in the unrestrained residents, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence). 4C) To evaluate whether pain severity mediates the effect of background factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, and ethnicity) on the frequency of disruptive behaviors in the unstrained residents.

Hypothesis for the fourth aim. 4A) Among the unstrained residents, disruptive behaviors will be more prevalent. 4B) Among the unstrained residents, pain severity will be significantly associated with increased frequency of disruptive behaviors, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence). 4C) Among the unstrained residents, pain severity will mediate the effect of background factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, and ethnicity) on the frequency of disruptive behaviors. The statistical analyses for the previous three aims will be reported separately using data among the unrestrained residents.

Table 3-1. Concepts, variables, measures, operational definitions and their interpretation

Variables	Instrument	MDS items	Range/interpretation	Reliability/validity
Pain	MDS-Pain severity Scale	Calculated from two MDS-pain items: pain frequency (MDS item # J2A) and pain intensity (MDS item # J2B)	0 (no pain), 1 (mild pain), 2 (moderate pain), 3 (excruciating pain)	Inter-rater reliability coefficient of 0.73, internal consistency coefficient of 0.69-0.88, test-retest reliability coefficient of 0.84-0.87, criterion validity coefficient of 0.70 with Visual Analogue Scale (Cohen-Mansfield, et al., 1999; Fisher, et al., 2002; Fries, et al., 2001)
Hunger	Complaints of Hunger	Complaints of Hunger (MDS item # K4B)	0 (No), 1 (Yes)	Reliability coefficient of 0.69 (Hawes, et al., 1995)
Thirst	Fluid intake	Dehydration (MDS item # J1C)	0 (No), 1 (yes)	Reliability coefficient of 0.49 (Hawes, et al., 1995)
Bowel elimination	Bowel continence	Bowel continence (MDS item # H1A)	0 (Continent), 1 (usually continent), 2 (occasionally incontinent), 3 (frequently incontinent), 4 (incontinent)	Correlation coefficient of 0.91 - 0.99, kappa coefficient of 0.61 (Casten, et al., 1998; Hawes, et al., 1995)
Bladder elimination	Bladder continence	Bladder continence (MDS item # H1B)	0 (Continent), 1 (usually continent), 2 (occasionally incontinent), 3 (frequently incontinent), 4 (incontinent)	Correlation coefficient of 0.91-0.99, kappa coefficient of 0.61 (Casten, et al., 1998; Hawes, et al., 1995)

Table 3-1. Continued

Variables	Instrument	MDS items	Range/interpretation	Reliability/validity
Neurocognitive factor	MDS-Cognitive performance scale (CPS)	Calculated from 5 MDS items: comatose (MDS item # B1), short-term memory (MDS item # B2A), cognitive skills or daily decision making (MDS item # B4), making oneself understood (MDS item # C4), and self-performance in eating (MDS item # G1HA).	0 (intact) 1 (borderline intact) 2 (mild impairment) 3 (moderate impairment) 4 (moderate severe impairment) 5 (severe impairment) 6 (very severe impairment)	High test-retest reliability, criterion validity coefficient of 0.45-0.75 with Mini-Mental State Examination, criterion validity coefficient of 0.41-0.77 against Global Deterioration Scale, criterion validity coefficient of 0.66 against Psychogeriatric Dependency Rating Scale, criterion validity coefficient of 0.45 against Mattis Dementia Rating Scale, sensitivity of 0.94, and specificity of 0.94 (Bula & Wietlisbach, 2009; Cohen-Mansfield, et al., 1999; Gruber-Baldini, et al., 2000; Hartmaier, et al., 1994; Hartmaier, et al., 1995; Lawton, et al., 1998; McConnell, et al., 2003; McConnell, et al., 2002; Morris, et al., 1994; Snowden, et al., 1999)
Comorbidity	Charlson Comorbidity Index	Charlson Comorbidity Index: Calculated from the list of specific diseases or infections or other current diagnoses (MDS item # I1 or I2 or I3)	0 - 37, with higher scores indicating greater comorbidity	MDS-items for calculating Charlson comorbidity index: Reliability coefficient of 0.74 (Hawes, et al., 1995)
Pressure ulcer	Pressure ulcer	Pressure ulcer (MDS item # M2)	0 (none) 1 (stage 1) 2 (stage 2) 3 (stage 3) 4 (stage 4)	Reliability coefficient of 0.62 (Hawes, et al., 1995)
Medications	The number of medications	The number of medications (MDS item # O1)	Actual number of different medications used in the last 7 days, with higher number indicating more medications	Reliability coefficient of 0.73 (Hawes, et al., 1995)

Table 3-1. Continued

Variables	Instrument	MDS items	Range/interpretation	Reliability/validity
ADL	MDS ADL-Long Form scale	The sum score of 7 MDS items: self-performance of bed mobility, transfer, locomotion on unit, eating, toile use, and personal hygiene (MDS item # G1AA, G1BA, G1EA, G1GA, G1HA, G1IA, and G1JA, respectively)	0 - 28, with higher scores indicating more ADL dependence	Reliability coefficient of 0.92-0.97, Inter-rater reliability coefficient of 0.61-0.95, criterion validity coefficient of 0.58 – 0.79 against Physical Self-Maintenance Scale (Hawes, et al., 1995; Lawton, et al., 1998; Sgadari, et al., 1997)
Sociodemographics	Sociodemographics	Age (MDS item # AA3), gender (MDS item # AA2), marital status (MDS item # A5), education (MDS item # AB7), and race/ethnicity (MDS item # AA4)		
Wandering behaviors	Wandering frequency	Wandering frequency (MDS item # E4AA): The frequency of movement with no rational purpose	0 (no wandering), 1 (wandering occurred 1-3 days in last 7 days), 2 (wandering occurred 4-6 days in last 7 days), 3 (wandering daily)	Reliability coefficient of 0.63, inter-rater reliability coefficient of 0.95, concurrent validity coefficient of 0.51-0.54 (Casten, et al., 1998; Hawes, et al., 1995; Lawton, et al., 1998; Sgadari, et al., 1997)
Aggressive behaviors	MDS-Aggression behavior scale (MDS-ABS)	The sum score of 4 MDS items: verbally abusive behavioral symptoms (MDS item # E4BA), physically abusive behavioral symptoms (MDS item # E4CA), socially inappropriate behavioral symptoms (MDS item # E4DA), resists care (MDS item # E4EA)	0 - 12, with higher scores indicating more aggressive behaviors	Internal consistency reliability of 0.79 to 0.95, criterion validity coefficient of 0.72 with Cohen-Mansfield Agitation Inventory aggression subscale scores (Perlman & Hirdes, 2008)
Agitated behaviors	MDS-Challenging Behavior Profile (MDS-CBP) agitation subscale	The sum score of 4 MDS items: periods of restlessness (MDS item # B5D), repetitive physical movements (MDS item # E1N), wandering (MDS item # E4AA), socially inappropriate behavior (MDS item # E4DA)	0 - 7, with higher scores indicating more agitated behaviors	Internal consistency reliability of 0.70, inter-rater reliability of 0.61, Spearman's rank correlation coefficient of 0.50 with Behavior Rating Scale for Psychogeriatric Inpatients (Gerritsen, et al., 2008)

Table 3-2. Charlson Comorbidity Index

Weight	Clinical Conditions	MDS item number	ICD 9 Code
1	myocardial infarct	MDS item # I1D	
	congestive heart failure	MDS item # I1F	
	peripheral vascular disease	MDS item # I1J	
	cerebrovascular disease	MDS item # I1T	
	dementia	MDS item # I1Q, I1U	
	chronic pulmonary disease	MDS item # I1II	
	connective tissue disease	MDS item # I3	7100, 7101, 7104, 7140, 7141, 7142, 71481, 5171, 725
	peptic ulcer disease	MDS item # I3	531, 532, 533, 534
	mild chronic liver disease or cirrhosis	MDS item # I2K	
	diabetes	MDS item # I1A	
2	hemiplegia	MDS item # I1V	
	moderate or severe renal disease	MDS item # I1QQ	
	diabetes with end organ damage	MDS item # I1KK	
	tumors	MDS item # I1PP	
	leukemia	MDS item # I3	204, 205, 206, 207, 208
	lymphoma	MDS item # I3	200, 201, 202
3	moderate or severe liver disease	MDS item # I3	5722, 5723, 5724, 5728
6	metastatic solid tumor	MDS item # I3	196, 197, 198, 1990, 1991
	AIDS	MDS item # I2D	

Table 3-3. Functional forms of variables

Variables	MDS item	Range/interpretation	Functional form
Proximal Factors			
Pain	MDS-Pain severity scale	0 (no pain), 1 (mild pain), 2 (moderate pain), 3 (excruciating pain)	Ordinal
Hunger	Complaints of Hunger (MDS item # K4B)	0 (No), 1 (Yes)	Dichotomous categorical
Thirst	Dehydration (MDS item # J1C)	0 (No), 1 (yes)	Dichotomous categorical
Elimination	Bowel continence (MDS item # H1A)	0 (Continent), 1 (usually continent), 2 (occasionally incontinent), 3 (frequently incontinent), 4 (incontinent)	Ordinal
	Bladder continence (MDS item # H1B)	0 (Continent), 1 (usually continent), 2 (occasionally incontinent), 3 (frequently incontinent), 4 (incontinent)	Ordinal
Background Factors			
Neurocognitive factor	MDS-Cognitive performance scale (MDS-CPS)	0 (intact) 1 (borderline intact) 2 (mild impairment) 3 (moderate impairment) 4 (moderate severe impairment) 5 (severe impairment) 6 (very severe impairment)	Ordinal
Comorbidity	Charlson Comorbidity Index	0 - 37, with higher scores indicating greater comorbidity	Continuous
Pressure ulcer	Pressure ulcer (MDS item # M2A)	0 (none) 1 (stage 1) 2 (stage 2) 3 (stage 3) 4 (stage 4)	Ordinal
Medications	The number of medications (MDS item # O1)	Actual number of different medications used in the last 7 days, with higher number indicating more medications	Continuous
ADL	MDS ADL-Long Form scale	0 - 28, with higher scores indicating more ADL dependence	Continuous
Age	Age	Actual age in years	Continuous

Table 3-3. Continued

Variables	MDS item	Range/interpretation	Functional form
Gender	Gender (MDS item # AA2)	1 (male) 2 (female)	Dichotomous categorical
Marital status	Marital status (MDS item # A5)	1 (never married) 2 (married) 3 (widowed) 4 (separated) 5 (divorced)	Nominal (5 groups)
Education	Education (MDS item # AB7)	1 (K-11 grade) 2 (high school) 3 (some college) 4 (Bachelor's degree) 5 (graduate degree)	Ordinal
Ethnicity	Ethnicity (MDS item # AA4)	1 (Indian/Asian) 2 (African American) 3 (Hispanic) 4 (Caucasian)	Nominal (4 groups)
Dependent Variables			
Wandering behaviors	MDS-Wandering frequency (MDS item # E4AA)	0 (no wandering), 1 (1-3 days in last 7 days), 2 (4-6 days in last 7 days), 3 (wandering daily)	Ordinal
Aggressive behaviors	MDS- Aggression behavior scale (MDS-ABS)	0 - 12, with higher scores indicating higher frequency	Continuous
Agitated behaviors	MDS-Challenging Behavior Profile (MDS-CBP) agitation subscale	0 - 7, with higher scores indicating more frequency of agitated behaviors	Continuous

CHAPTER 4
RESULTS

The purpose of this study was to explore the relationship between pain and disruptive behaviors (e.g., wandering, aggressive, and agitated behaviors) among NH residents with dementia. This study had four specific aims: (1) to describe the prevalence of disruptive behaviors in NH residents with dementia, (2) to investigate the effect of pain severity on the frequency of disruptive behaviors after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence), (3) to evaluate the mediator effect of pain severity on the relationship between background factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairment, age, gender, marital status, education, and race/ethnicity) on the frequency of disruptive behaviors, and (4) to investigate those previous three aims in the unrestrained residents.

Sample Selection Process

The sample selection process is summarized in Figure 4-1. First, admission or annual MDS data for non-comatose NH residents in Florida during calendar year 2009 was obtained from Centers for Medicare and Medicaid Service (N=197,097 cases). Then, cases in which there is no diagnosis of dementia (N=130,955 cases), cases in which residents are less than 65 years old (N=2,840 cases), and duplicate cases (N= 6,725 duplicate cases) were excluded. This selection process yields 56,577 unique cases for the analyses.

Description of the Sample

In this section, descriptive statistics for the study variables are presented. Analyses are organized according to the theoretical model, and presented as background factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity), proximal factors (e.g., pain, hunger, thirst, bowel incontinence, and bladder incontinence), and disruptive behaviors (e.g., wandering, aggressive, and agitated behaviors). Means and standard deviations are presented for continuous variables and frequencies are presented for categorical variables.

Prevalence of Background Factors

Background factors among the study sample (N=56,577) are summarized in Table 4-1. On the average, subjects are 84 years of age (SD = ± 7 years). The majority of subjects are female (67.7%), widowed (53.7%), high school graduates or less (72.4%), Caucasian (78.7%), and mildly or moderately cognitively impaired (54.8%). Subjects have a mean Charlson Comorbidity Index score of 3 (SD = ± 2); take a mean of 11 medications (SD = ± 5); and have a mean MDS-ADL impairment score of 19 (SD = ± 6). The prevalence of pressure ulcer is 18.1%.

Prevalence of Proximal Factors

A description of proximal factors (e.g., pain, hunger, thirst, bowel and bladder incontinence) among the study sample (N=56,577) is summarized in Table 4-2. The prevalence of proximal factors is as follows: pain (36.9%), hunger (.1%), thirst (.1%), bowel incontinence (57.7%), and bladder incontinence (64.4%).

Main Study Results

Aim 1: Prevalence of Disruptive Behaviors

The first aim of this study is to describe the prevalence of disruptive behaviors (e.g., wandering, aggressive, and agitated behaviors) in NH residents with dementia. The prevalence of disruptive behaviors is: wandering behaviors (9.0%), aggressive behaviors (24.4%), and agitated behaviors (30.4%) (Table 4-3).

Aim 2: The Effect of Pain Severity on the Frequency of Disruptive Behaviors

The second aim of this study is to investigate the effect of pain severity on the frequency of disruptive behaviors in NH residents with dementia, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence). The hypothesis was that pain severity would be significantly associated with increased frequency of disruptive behaviors when the effects of the other background/proximal factors are held constant.

Analysis approach

In order to control for the other background/proximal factors, the ordinal logistic regression analysis was used to evaluate the effect of pain severity on the frequency of disruptive behaviors (e.g., wandering, aggressive, and agitated behaviors). Initially, ordinal logistic regression was planned to evaluate the effect of pain severity on the frequency of wandering behaviors, and multiple regression analysis was planned to evaluate the effect of pain severity on the frequency of aggressive and agitated behaviors; the dependent variable wandering is expressed as an ordinal variable, and aggressive and agitated behaviors are expressed as continuous variables. However, both aggressive and agitated behaviors were severely positively skewed, and assumptions for multiple regression were violated (e.g., homoscadesiticity of error term, normal distribution of error term, and independence of error term). Also, none of the transformations available to solve positively skewed data (e.g., logarithmic transformation, square root transformation, inverse transformation, and square transformation) resolved the normality distribution problem. Therefore, aggressive behaviors (MDS-ABS scores) were collapsed into four groups: none (MDS-ABS = 0), moderate (MDS-ABS = 1 - 2), severe (MDS-ABS = 3 - 5), and very severe (ABS= 6 - 12), based on an established algorithm (Perlman &

Hirdes, 2008). Also, agitated behaviors (MDS-CBP-agitation scores) were collapsed into four groups: 0, 1, 2, 3, with higher numbers indicating more frequent agitated behaviors. Since the dependent variables were expressed in an ordinal format, ordinal logic regression was used to evaluate the effect of pain severity on the frequency of all three disruptive behaviors, after controlling for the other background/proximal factors.

After conducting bivariate analyses between background/proximal factors and disruptive behaviors, the assumptions for ordinal logistic regression were evaluated (e.g., empty cells between categorical variables, influential outliers, and multicollinearity). There are no influential outliers or multicollinearity. Hunger and/or thirst variables had empty cells in a crosstab between wandering and aggression, and were subsequently excluded from the analyses.

The analytical steps used to conduct and evaluate the ordinal logistic regression analysis are outlined below. First, the statistical significance of the logistic regression model is determined by the -2 log likelihood (-2LL). If -2LL is statistically significant, then the ordinal logistic model is assumed to fit significantly better than the null model with no predictors. Then, the Nagelkerke R-square, is used to evaluate the variance of the dependent variable that is explained by predictors. The Nagelkerke R-square refers to the variance of the dependent variable which can be explained by independent variables, and is interpreted like an R-square in a multiple regression analysis. Finally, the extent to which individual coefficients predict the dependent variable is interpreted using odds ratio and the *p*-value. For every unit increase in the value of the predictor, the odds of the being one unit higher in the dependent variable is evaluated by odds ratio.

Most of the variables have very little missing values (less than 1%). One covariate, highest level of education, had 22% missing values. For the logistic regression, listwise deletion method is used to handle missing values. Multiple approaches were investigated to estimate missing values. For ordinal level variables, substitution with the subgroup mode was considered as an acceptable approach (Polit, 2010). Thus, subgroup mean (mode) substitution method is used in order to compare the precision and trends in the results. Missing values on education are replaced using mode for ethnicity. The missing values on education for Indian/Asian and Caucasian are imputed as high school graduates, those for African American and Hispanic are imputed as less than high school graduates.

Using the same independent variables in analysis with different dependent variables carries the risk of inflating the Type I error. To keep the overall risk of a Type I error to the 5% level, *p*-value for the each regression analysis is set at .017 (.05/3; divided by the number of tests conducted) (Polit, 2010).

Bivariate relationships between background/proximal factors and disruptive behaviors

The bivariate analyses between background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, pain, hunger, thirst, bowel incontinence, and bladder incontinence) and the frequency of disruptive behaviors are summarized in Table 4-4 and Table 4-5. For the relationship between background factors and the frequency of disruptive behaviors, all the background factors except education level are significantly related to all three disruptive behaviors. Among background factors, only cognitive impairments are positively correlated with disruptive behaviors. Most of the background factors (e.g., Charlson Comorbidity Index, pressure ulcer, number of medications, and age) are negatively correlated with the frequency of disruptive behaviors. For gender, male is correlated with higher frequency of disruptive behaviors than female. For marital status, separated residents are correlated with higher frequency of disruptive behaviors the other residents. For ethnicity, African Americans are correlated with more frequent wandering or aggressive behaviors than the other ethnicity groups, and Hispanics are associated with more frequent agitated behaviors.

For the relationship between proximal factors and the frequency of disruptive behaviors, pain severity is negatively correlated with all three disruptive behaviors (wandering: Spearman's correlation = -.090, aggression: Spearman's correlation = -.038, agitation: Spearman's correlation = -.043, respectively; $p < .001$), but the other proximal factors (e.g., hunger, thirst, bowel incontinence, and bladder incontinence) show non-significant or equivocal relationships with the various disruptive behaviors examined.

The effect of pain severity on the frequency of wandering behaviors

Ordinal logistic regression analysis was used to evaluate the effect of pain severity on the frequency of wandering behaviors, after controlling for the other background/proximal factors. The -2 log likelihood, the Nagelkerke R square, odds ratio, and the *p*-value was used to evaluate the statistical significance. The results indicated that the ordinal logistic model fitted significantly better than the null model with no predictors (-2 log likelihood = 29,283.252, Chi-square = 4,753.104, $p = .000$). Nagelkerke R-square showed that 19% of the variance of the wandering behaviors could be explained by these background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, pain, bowel incontinence, and bladder incontinence).

Pain severity is negatively associated with the frequency of wandering behaviors, after controlling for the other background/proximal factors (OR=.75, p =.000) (Table 4-6). For every unit increase in MDS-Pain severity score (e.g., none to mild pain, mild to moderate pain, or moderate to excruciating pain), the odds of the being one unit higher frequency in wandering behaviors (e.g., none to 1 - 3 days exhibition, 1 - 3 days exhibition to 4 - 6 days exhibition, or 4 -

6 exhibition to daily wandering) is 25% decreased, after controlling for the other background/proximal factors in the model.

The effect of pain severity on the frequency of aggressive behaviors

Ordinal logistic regression analysis was used to evaluate the effect of pain severity on the frequency of aggressive behaviors, after controlling for the other background/proximal factors. The results indicated that the ordinal logistic regression model fitted significantly better than the null model with no predictors (-2 log likelihood = 60,707.294, Chi-square = 2824.689, p = .000). Nagelkerke R-square showed that 8.2% of the variance of the aggressive behaviors could be explained by these background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, pain, hunger, bowel incontinence, and bladder incontinence).

Pain severity is positively associated with the frequency of aggressive behaviors, after controlling for the other background/proximal factors (OR=1.05, p =.010) (Table 4-7). For every unit increase in MDS-Pain severity score (e.g., none to mild pain, mild to moderate pain, or moderate to excruciating pain), the odds of the being one unit higher frequency in aggressive behaviors (e.g., none to moderate, moderate to severe, or severe to very severe frequent behaviors) is increased by 5%, after controlling for the other background/proximal factors in the model.

The effect of pain severity on the frequency of agitated behaviors

Ordinal logistic regression analysis was also used to evaluate the effect of pain severity on the frequency of agitated behaviors, after controlling for the other background/proximal factors. The ordinal logistic regression model fitted significantly better than null model with no predictors (-2 log likelihood = 76,952.644, Chi-square = 5,173.731, p = .000). Nagelkerke R-square showed that 13% of the variance of the aggressive behaviors could be explained by these background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, pain, hunger, thirst, bowel incontinence, and bladder incontinence).

Pain severity is positively associated with the frequency of agitated behaviors, after controlling for the other background/proximal factors (OR=1.06, p =.000) (Table 4-8). For every unit increase in MDS-Pain severity score (e.g., none to mild pain, mild to moderate pain, or moderate to excruciating pain), the odds of the being one unit higher frequency in agitated behaviors is increased by 6%, after controlling for the other background/proximal factors.

The statistical results of the model using imputation methods

To determine whether the extent of missing data on the education variable and the listwise deletion influenced the study results, the analyses were rerun using subgroup mean (mode) substitution. These results are summarized in Table 4-9, 4-10, and 4-11. The statistical results are almost identical between the model using listwise deletion and the model using subgroup mean (mode) substitution. In both models, pain severity is negatively associated with the frequency of wandering behaviors, but positively associated with the frequency of aggressive and agitated behaviors, after controlling for the other background/proximal factors.

Summary of the results of the Aim 2

Pain severity is negatively associated with the frequency of disruptive behaviors in bivariate analysis (Spearman's correlation = -.090 − -.038; p < .001). In multivariate ordinal logistic regression, pain severity is negatively associated with the frequency of wandering behaviors (OR=.75, p =.000), but positively associated with the frequency of aggressive and agitated behaviors (OR=1.05, p =.010; OR=1.06, p =.000; respectively), after controlling for the other background/proximal factors. The hypothesis that pain severity would be significantly associated with increased frequency of wandering behaviors is not supported, but the hypothesis that pain severity would be significantly associated with increased frequency of aggressive or agitated behaviors is supported.

Aim 3: Mediating Effect of Pain Severity on Disruptive Behaviors

The third aim of this study is to evaluate whether pain severity mediates the effect of background factors (e.g., neurocognitive factors, comorbidity, pressure ulcer, number of medications, ADL impairment, age, gender, marital status, education, and race/ethnicity) on the frequency of disruptive behaviors (e.g., wandering, aggression, and agitation). The hypothesis was that pain severity would mediate the relationship between background factors and disruptive behaviors.

Analysis approach

Path analysis using a series of ordinal logistic regression analyses was used to evaluate this mediation model. Initially, path analysis using ordinal logistic regression was planned to evaluate the mediating effect of pain on the frequency of wandering behaviors, and path analysis using multiple regression was planned for the models with aggressive and agitated behaviors because the dependent variable wandering is expressed as an ordinal variable, and aggressive and agitated behaviors are expressed in a continuous variable. However, both aggressive and agitated behaviors were severely positively skewed, and assumptions for multiple regression were violated (e.g., homoscadesiticity of error term, normal distribution of error term, independence of error term). Also, none of the transformations available to solve positively skewed data (e.g., logarithmic transformation, square root transformation, inverse transformation, and square transformation) resolved the normality distribution problem. Therefore, aggressive and agitated behaviors were collapsed into four groups, as in the previous analysis for the second aim. Since the dependent variable is expressed as an ordinal variable, ordinal logic regression is used for path analysis to evaluate the mediating effect of pain severity on the relationship between background factors and the frequency of all three disruptive behaviors.

After conducting bivariate analysis between background factors and pain severity or the frequency of disruptive behaviors, the assumptions for ordinal logistic regression are evaluated (e.g., empty cells between categorical variables, influential outliers and multicollinearity). There are no violations of the assumptions.

To evaluate the potential role of pain as a mediator, three ordinal logistic regressions analyses are performed, following the approach outlined by Baron and Kenny (1986). These include (1) the regression between background factor (predictor) and disruptive behavior (outcome), (2) the regression between background factor (predictor) and pain (mediator), and (3) the regression among background factor and pain as independent variables with disruptive behavior as a dependent variable (Baron & Kenny, 1986; Holmbeck, 1997). In step one, the relationship between background factor (predictor) and disruptive behaviors (outcome) is estimated. If the regression between background factor (predictor) and disruptive behavior (outcome) is statistically significant, then the second step will be taken. In step two, the relationship between background factor (predictor) and pain (mediator) is estimated. If the relationship between background factor (predictor) and pain (mediator) is also statistically significant, then the third step can be done. In step three, the regression among background factor and pain (independent variables) and disruptive behaviors (dependent variable) is estimated. If the relationship between background factors (predictor) and disruptive behaviors (outcome) is not statistically significant, and the relationship between pain (mediator) and disruptive behaviors (outcome) is significant ($p < .05$), the mediator relationship is deemed to exist. There should be non-significant relationship between background factors (predictor) and disruptive behaviors (outcome) when pain (mediator) is in the regression model (Bennett, 2000; Holmbeck, 1997). During these three steps, the next step cannot be done if the previous step does not show significant result.

Using the same independent variables in analysis with different dependent variables carries the risk of inflating the Type I error. To keep overall risk of a Type I error to the 5% level, *p*-value for the each regression analysis is set at .017 (.05/3; divided by the number of tests conducted) (Polit, 2010).

Bivariate analyses between background factors and pain severity or frequency of disruptive behaviors

The bivariate analyses between background factors and pain severity are summarized in Table 4-4. For the relationship between background factors and the pain severity, all the background factors are significantly correlated with pain severity, except Charlson Comorbidity Index. Pain severity is positively correlated with pressure ulcer, number of medications, and education level. However, pain severity is negatively correlated with cognitive impairments, ADL impairments, and age. For gender, female is correlated with higher pain severity than male. For marital status, married or widowed residents are correlated with higher pain severity than never-married residents. For ethnicity, Caucasian residents are correlated with higher severity of pain than non-Caucasian.

For the relationship between background factors and the frequency of disruptive behaviors and between pain intensity and the frequency of disruptive behaviors, refer to bivariate analyses in the aim 2 (page 124).

The mediating effect of pain severity on the relationship between background factors and the frequency of wandering behaviors

The mediating effect of pain severity on the relationship between background factors and the frequency of wandering behaviors is summarized in Table 4-12.

Cognitive impairments and wandering. The mediating effect of pain severity on the relationship between cognitive impairments on the frequency of wandering behaviors is examined using a series of ordinal logistic regression analyses (Holmbeck, 1997). The first step of path analysis, regression analysis of cognitive impairment (predictor) on wandering (outcome), is statistically significant (OR= 1.32, p =.000). The second step of path analysis, regression analysis of cognitive impairment (predictor) on pain severity (mediator), is statistically significant (OR= .73, p =.000). The third step of path analysis, regression analysis of cognitive impairment and pain severity (predictor and mediator) on wandering (outcome), is statistically significant (cognitive impairment: OR= 1.27, p =.000; pain severity: OR= .64, p =.000). The relationship between cognitive impairments (predictor) and wandering behaviors (outcome) is still significant, after controlling for pain severity (mediator). There should be non-significant relationship between cognitive impairments (predictor) and wandering (outcome) when pain severity (mediator) is in the regression model, if the mediating effect exists (Bennett, 2000; Holmbeck, 1997). Therefore, there is no mediator effect of pain severity on the relationship between cognitive impairment and the frequency of wandering behaviors.

Charlson comorbidity index and wandering. The mediating effect of pain severity on the relationship between Charlson Comorbidity Index (CCI) and the frequency of wandering behaviors is examined using a series of ordinal logistic regression. The first step of path analysis, regression analysis of CCI (predictor) on wandering (outcome), is statistically significant (OR= .77, p =.000). The second of path analysis, regression analysis of CCI (predictor) on pain severity (mediator), is not statistically significant (OR= 1.00, p =.400). The third step of path analysis, regression analysis of CCI and pain severity (predictor and mediator) on wandering (outcome), cannot be executed because the second step shows a non-significant relationship (Bennett, 2000;

Holmbeck, 1997). There is no mediator effect of pain severity on the relationship between CCI and the frequency of wandering behaviors.

Pressure ulcer and wandering. The mediating effect of pain severity on the relationship between pressure ulcer on the frequency of wandering behaviors is examined using a series of ordinal logistic regression. The first step of path analysis, regression analysis of pressure (predictor) on wandering (outcome), is statistically significant (OR= .54, p =.000). The second step of path analysis, regression analysis of pressure ulcer (predictor) on pain severity (mediator) is statistically significant (OR= 1.24, p =.000). The third step of path analysis, regression analysis of pressure ulcer and pain severity (predictor and mediator) on wandering (outcome), is statistically significant (pressure ulcer: OR= .56, p =.000; pain severity: OR= .60, p =.000). The relationship between pressure ulcer (predictor) and wandering behaviors (outcome) is still significant, after controlling for pain severity (mediator). There should be non-significant relationship between pressure ulcer (predictor) and wandering (outcome) when pain severity (mediator) is in the regression model, if the mediating effect exists (Bennett, 2000; Holmbeck, 1997). Therefore, there is no mediator effect of pain severity on the relationship between pressure ulcer and the frequency of wandering behaviors.

Number of medications and wandering. The mediating effect of pain severity on the relationship between number of medications and the frequency of wandering is examined. The first step of path analysis, regression analysis of number of medications (predictor) on wandering (outcome), is statistically significant (OR= .94, p =.000). The second step of path analysis, regression analysis of number of medications (predictor) on pain severity (mediator), is statistically significant (OR= 1.12, p =.000). The third step of path analysis, regression analysis of number of medications and pain severity (predictor and mediator) on wandering (outcome), is statistically significant (number of medications: OR= .95, *p* =.000; pain severity: OR= .62, *p* =.000). The relationship between number of medications (predictor) and wandering behaviors (outcome) is still significant, after controlling for pain severity (mediator). There should be non-significant relationship between number of medications (predictor) and wandering (outcome) when pain severity (mediator) is in the regression model, if the mediating effect exists (Bennett, 2000; Holmbeck, 1997). Therefore, there is no mediator effect of pain severity on the relationship between pressure ulcer and the frequency of wandering behaviors.

ADL impairments and wandering. The mediating effect of pain severity on the relationship between ADL impairments and the frequency of wandering is examined. The first step of path analysis, regression analysis of ADL impairments (predictor) on wandering (outcome), is statistically significant (OR= .92, *p* =.000). The second step of path analysis, regression analysis of ADL impairments (predictor) on pain severity (mediator), is not statistically significant (OR= 1.00, *p* =.304). The third step of path analysis, regression analysis of ADL impairments and pain severity (predictor and mediator) on wandering (outcome) cannot be executed because the second step shows non-significant relationship (Bennett, 2000; Holmbeck, 1997). There is no mediator effect of pain severity on the relationship between ADL impairments and the frequency of wandering behaviors.

Age and wandering. The mediating effect of pain severity on the relationship between age and the frequency of wandering is examined. The first step of path analysis, regression analysis of age (predictor) on wandering (outcome), is statistically significant (OR= .98, *p* =.000). The second step of path analysis, regression analysis of age (predictor) on pain severity (mediator), is statistically significant (OR= .99, *p* =.000). The third step of path analysis, regression analysis of age and pain severity (predictor and mediator) on wandering (outcome), is statistically significant (age: OR= .98, *p* =.000; pain severity: OR= .56, *p* =.000). The relationship between age (predictor) and wandering behaviors (outcome) is still significant, after controlling for pain severity (mediator). There should be non-significant relationship between age (predictor) and wandering (outcome) when pain severity (mediator) is in the regression model, if the mediating effect exists (Bennett, 2000; Holmbeck, 1997). Therefore, there is no mediator effect of pain severity on the relationship between age and the frequency of wandering behaviors.

Gender and wandering. The mediating effect of pain severity on the relationship between gender and the frequency of wandering is examined. The first step of path analysis, regression analysis of gender (predictor) on wandering (outcome), is statistically significant (male: OR= 1.24, *p* =.000). The second step of path analysis, regression analysis of gender (predictor) on pain severity (mediator), is statistically significant (male: OR= .80, *p* =.000). The third step of path analysis, regression analysis of gender and pain severity (predictor and mediator) on wandering (outcome), is statistically significant (male: OR= 1.20, *p* =.000; pain severity: OR= .57, *p* =.000). The relationship between gender (predictor) and wandering behaviors (outcome) is still significant, after controlling for pain severity (mediator). There should be non-significant relationship between gender (predictor) and wandering (outcome) when pain severity (mediator) is in the regression model, if the mediating effect exists (Bennett, 2000; Holmbeck, 1997). Therefore, there is no mediator effect of pain severity on the relationship between gender and the frequency of wandering behaviors.

Marital status and wandering The mediating effect of pain severity on the relationship between marital status on the frequency of wandering behaviors. Marital status is dichotomized for the analysis, married versus not married. The first step of path analysis, regression analysis of marital status (predictor) on wandering (outcome), is statistically significant (married: OR= 1.19, *p* =.000). The second step of path analysis, regression analysis of married status (predictor) on pain severity (mediator), is statistically significant (married: OR= 1.06, *p* =.002). The third step of path analysis, regression analysis of marital status and pain severity (predictor and mediator) on wandering (outcome), is statistically significant (married: OR= 1.21, *p* =.000; pain severity: OR= .57, *p* =.000). The relationship between marital status (predictor) and wandering behaviors (outcome) is still significant, after controlling for pain severity (mediator). There should be non-significant relationship between marital status (predictor) and wandering (outcome) when pain severity (mediator) is in the regression model, if the mediating effect exists (Bennett, 2000; Holmbeck, 1997). Therefore, there is no mediator effect of pain severity on the relationship between marital status and the frequency of wandering behaviors.

Education level and wandering behaviors. The mediating effect of pain severity on the relationship between educational level and the frequency of wandering is examined. The first step of path analysis, regression analysis of level of highest education (predictor) on wandering (outcome), is not statistically significant (OR= 1.00, *p* =.855). The next step of path analysis cannot be executed because the first step shows non-significant relationship (Bennett, 2000; Holmbeck, 1997). There is no mediator effect of pain severity on the relationship between level of education and the frequency of wandering behaviors.

Ethnicity and wandering behaviors. The mediating effect of pain severity on the relationship between ethnicity on the frequency of wandering behaviors is examined using a series of ordinal logistic regression. Ethnicity is dichotomized for the analysis, minority and Caucasian. The first step of path analysis, regression analysis of ethnicity (predictor) on wandering (outcome), is statistically significant (minority: OR= .89, *p* =.001). The second step of path analysis, regression analysis of ethnicity (predictor) on pain severity (mediator), is statistically significant (minority: OR= .62, p =.000). The third step of path analysis, regression analysis of ethnicity and pain severity (predictor and mediator) on wandering (outcome), is statistically significant (minority: OR= .82, p =.000; pain severity: OR= .56, p =.000). The relationship between ethnicity (predictor) and wandering behaviors (outcome) is still significant, after controlling for pain severity (mediator). There should be non-significant relationship between ethnicity (predictor) and wandering (outcome) when pain severity (mediator) is in the regression model, if the mediating effect exists (Bennett, 2000; Holmbeck, 1997). Therefore, there is no mediator effect of pain severity on the relationship between ethnicity and the frequency of wandering behaviors.

In summary, there is no evidence of a mediating effect of pain severity on the relationship between any of the background factors and the frequency of wandering behaviors (Table 4-12).

The mediating effect of pain severity on the relationship between background factors on the frequency of aggressive behaviors

The same analytical approach was used to examine the mediating effect of pain severity on the relationship between background factors and the frequency of aggressive behaviors (Table 4-13). There is no evidence of a mediating effect of pain severity on the relationships between background factors and the frequency of aggressive behaviors. Refer to Table 4-13 for details on the mediating effect of pain severity on the relationship between any of the background factors and the frequency of aggressive behaviors.

The mediating effect of pain severity on the relationship between background factors on the frequency of agitated behaviors

The same analytical approach was used to examine the mediating effect of pain severity on the relationship between background factors and the frequency of agitated behaviors (Table 4-14). There is no evidence of a mediating effect of pain severity on the relationships between any of the background factors and the frequency of agitated behaviors. Refer to Table 4-14 for details on the mediating effect of pain severity on the relationship between background factors and the frequency of agitated behaviors.

Summary of the results of the aim 3

There is no mediating effect of pain severity on the relationship between background factors and the frequency of disruptive behaviors. The hypothesis that pain severity would mediate the effect of background factors on the frequency of disruptive behaviors is not supported.

Summary of Findings

For the first aim, the prevalence of disruptive behaviors ranges from 9 − 30% (wandering: 9.0%, aggression: 24.4%, and agitation: 30.4%). For the second aim, pain severity is negatively associated with the frequency of wandering behaviors (OR=.75, p =.000), but positively associated with the frequency of aggressive and agitated behaviors (OR=1.05, p =.010; OR=1.06, p =.000; respectively), after controlling for the other background/proximal factors. The hypothesis that pain severity would be significantly associated with increased frequency of wandering behaviors is not supported, but the hypothesis that pain severity would be significantly associated with increased frequency of aggressive or agitated behaviors is supported. For the third aim, no mediating effect of pain severity is found. The hypothesis that pain severity would mediate the effect of background factors on the frequency of disruptive behaviors is not supported.

Study Results in Unrestrained Residents

All of the prior results regarding the relationship between pain severity and the frequency of disruptive behaviors are examined without controlling for the use of physical or chemical restraints. However, residents with restraints may not exhibit disruptive behaviors even when they have pain. Therefore, the study aims were tested again in the unrestrained residents (N =

12,991), after excluding residents who are restrained. Means and standard deviations are presented for continuous variables and frequencies are presented for categorical variables.

The number and percentage of restrained residents among 56,577 NH residents with dementia are summarized in Table 4-15. There are 43,585 residents (77%) who had physical restraints or psychoactive medications during the last 7 days. Physical restraints were used in 15,300 residents (27%), such as trunk restraints, limb restraints, restraint chair, and bed rails. Also, there are 39,141 residents (69.2%) had psychoactive medications, such as antipsychotics, antianxiety, antidepressant, and hypnotics.

Prevalence of Background Factors in Unrestrained Residents

The prevalence of background factors (e.g., age, gender, marital status, education, ethnicity, cognition, Charlson Comorbidity Index score, pressure ulcer, number of medications, and ADL impairments) among unrestrained residents (N = 12,991) is summarized in Table 4-16. Subjects in the subsample have a mean age of 85 years (SD = ± 7 years). The majority of subjects in the subsample are female (66.7%), widowed (54.4%), high school graduates or less (72.1%), Caucasian (77.2%), and mildly or moderately cognitively impaired (53.1%). Subjects in the subsample have an average Charlson Comorbidity Index score of 3 (SD = ± 2); take a mean of 9 medications (SD = ± 5); and have an average MDS-ADL impairment score of 19 (SD = ± 7). The prevalence of pressure ulcer in the unrestrained residents is 20.7%.

Prevalence of Proximal Factors in Unrestrained Residents

The prevalence of proximal factors among unrestrained residents (N = 12,991) is summarized in Table 4-17. The prevalence of proximal factors in the unrestrained residents is as follows: pain (35.1%), hunger (.1%), thirst (< .1%), bowel incontinence (61.8%), and bladder incontinence (67.3%).

Prevalence of Disruptive Behaviors in Unrestrained Residents (Aim 1)

The prevalence of disruptive behaviors among unrestrained residents is as follows: wandering behaviors (5.0%), aggressive behaviors (14.2%), and agitated behaviors (16.9%) (Table 4-18). In contrast to the hypothesis that disruptive behaviors would be more prevalent among the unrestrained residents, the prevalence of these behaviors is lower than it is among the total sample. The prevalence of wandering decreased from 9% to 5%, aggressive behaviors decreased from 24.4% to 14.2%, and agitated behaviors decreased from 30.4% to 16.9% in the subsample.

The Effect of Pain on Disruptive Behaviors in Unrestrained Residents (Aim 2)

Among unrestrained residents, the effect of pain severity on the frequency of disruptive behaviors, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, hunger, thirst, bowel incontinence, and bladder incontinence), were examined using ordinal logistic regression. The hypothesis was that pain severity would be significantly associated with increased frequency of disruptive behaviors, after controlling for the other background/proximal factors. After conducting bivariate analyses, the assumptions for ordinal logistic regression were evaluated (e.g., empty cells between categorical variables, influential outliers and multicollinearity). Hunger and thirst were excluded from the ordinal logistic analysis because there are empty cells in a crosstab between these variables and disruptive behaviors. There are no influential outliers or multicollinearity problems. For the logistic regression, listwise deletion method was used to handle missing values. Also, subgroup mean (mode) substitution method was used in order to compare the precision and trends in the results. Missing values on education were replaced using the mode separately for ethnicity. The missing values on education for Indian/Asian and Caucasian are imputed as high school graduates; those for African American and Hispanic are imputed as less than high school graduates. To keep overall risk of a Type I error to the 5% level, *p*-value for the each regression analysis is set at .017 (.05/3; divided by the number of tests conducted) (Polit, 2010).

Bivariate analyses between background/proximal factors and the frequency of disruptive behaviors in the unrestrained residents

The bivariate analyses between background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, pain, hunger, thirst, bowel incontinence, and bladder incontinence) and the frequency of disruptive behaviors are summarized in Table 4-19 and Table 4-20. For the relationship between background factors and the frequency of disruptive behaviors, only cognitive impairments are positively correlated with disruptive behaviors. Charlson Comorbidity Index, pressure ulcer, and number of medications are negatively correlated with disruptive behaviors. The other background factors (e.g., ADL impairments, age, gender, marital status, education, ethnicity, pain, hunger, thirst, bowel incontinence, and bladder incontinence) are not significantly correlated with at least one of disruptive behaviors.

For the relationship between proximal factors and the frequency of disruptive behaviors, pain severity is negatively correlated with the frequency of all three disruptive behaviors (wandering: Spearman's correlation = -.078, aggression: Spearman's correlation = -.031, agitation: Spearman's correlation = -.035, respectively; $p < .001$), but the other proximal factors (e.g., hunger, thirst, bowel incontinence, and bladder incontinence) show non-significant or equivocal relationships with the various disruptive behaviors examined. This result is similar to the previous results using all the subjects.

The effect of pain severity on the frequency of wandering behaviors in the unrestrained residents

In the multivariate ordinal logistic regression, pain severity is shown to be negatively associated with the frequency of wandering behaviors (OR = .68, p = .000), after controlling for the other background/proximal factors (Table 4-21). For every unit increase in MDS-Pain severity score (e.g., none to mild pain, mild to moderate pain, or moderate to excruciating pain), the odds of the being one unit higher frequency in wandering behaviors (e.g., none to 1 - 3 days exhibition, 1 - 3 days exhibition to 4 - 6 days exhibition, or 4 - 6 exhibition to daily wandering) is 32% decreased, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, bowel incontinence, and bladder incontinence).

The effect of pain severity on the frequency of aggressive behaviors in the unrestrained residents

In the multivariate ordinal logistic regression, pain severity is shown to be positively associated with the frequency of aggressive behaviors (OR = 1.10, p = .032), after controlling for the other background/proximal factors (Table 4-22). For every unit increase in MDS-Pain severity score (e.g., none to mild pain, mild to moderate pain, or moderate to excruciating pain), the odds of the being one unit higher frequency in aggressive behaviors (e.g., none to moderate, moderate to severe, or severe to very severe frequent behaviors) is increased by 10%, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, pain, bowel incontinence, and bladder incontinence).

The effect of pain severity on the frequency of agitated behaviors in the unrestrained residents

In the multivariate ordinal logistic regression, pain severity is shown to be negatively associated with the frequency of agitated behaviors (OR = 1.11, p = .016), after controlling for the other background/proximal factors (Table 4-23). For every unit increase in MDS-Pain severity score (e.g., none to mild pain, mild to moderate pain, or moderate to excruciating pain), the odds of the being one unit higher frequency in agitated behaviors is increased by 11%, after controlling for the other background/proximal factors (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, pain, bowel incontinence, and bladder incontinence).

The statistical results of the model using imputation methods

The statistical results after imputing education using subgroup mean (mode) substitution are summarized in Table 4-24, 4-25, and 4-26. The statistical results are essentially unchanged between the models using listwise deletion and the models using subgroup mean (mode) substitution. In both models, pain severity is negatively associated with the frequency of wandering behaviors, but positively associated with the frequency of aggressive and agitated behaviors, after controlling for the other background/proximal factors.

Summary of the results of the aim 2 among the unrestrained residents

Pain severity is negatively associated with the frequency of disruptive behaviors in bivariate analysis (Spearman's correlation = -.078 − -.031; p < .001). In multivariate ordinal logistic regression, pain severity is negatively associated with the frequency of wandering behaviors (OR = .68, p = .000), but positively associated with the frequency of aggressive and agitated behaviors (OR = 1.10, p = .032; OR = 1.11, p = .016; respectively), after controlling for the other background/proximal factors. The hypothesis that pain severity would be significantly associated with increased frequency of wandering behaviors is not supported, but the hypothesis that pain severity would be significantly associated with increased frequency of aggressive or agitated behaviors is supported.

Mediating Effect of Pain in the Unrestrained Residents (Aim 3)

Among unrestrained residents, the mediating effect of pain severity on the relationship between background factors and the frequency of disruptive behaviors was examined using path analysis composed of a series of ordinal logistic regression analyses. The hypothesis was that pain severity would mediate the effect of background factors on the frequency of disruptive behaviors. After conducting bivariate analysis between background factors and pain severity or the frequency of disruptive behaviors, the assumptions for ordinal logistic regression (empty cells between categorical variables, influential outliers and multicollinearity) are evaluated. There are no violations of the assumptions. To keep overall risk of a Type I error to the 5% level, *p*-value for the each regression analysis is set at .017 (.05/3; divided by the number of tests conducted) (Polit, 2010).

Bivariate analyses between background factors and pain severity or frequency of disruptive behaviors in the unrestrained residents

The bivariate analyses between background factors and pain severity are summarized in Table 4-19. For the relationship between background factors and pain severity, all the background factors are significantly correlated with pain severity. Pain severity is positively correlated with pressure ulcer, number of medications, and education level. However, pain severity is negatively correlated with cognitive impairments, Charlson Comorbidity Index, ADL impairments, and age. For gender, female is correlated with higher severity of pain than male. For marital status, married or widowed or divorced residents are more highly correlated with higher pain severity than never-married residents. For ethnicity, Caucasian residents are correlated with higher severity of pain than African American residents.

For the relationship between background factors and the frequency of disruptive behaviors and between pain intensity and the frequency of disruptive behaviors, refer to bivariate analyses in the aim 2 (page 139).

Multivariate analyses for mediating effect of pain severity in the unrestrained residents

The mediating effects of pain on the relationship between background factors on disruptive behaviors (wandering, aggression, and agitation) are examined using a series of ordinal logistic regression analyses (Baron & Kenny, 1986; Holmbeck, 1997). The mediating effects of pain on the relationship between background factors and disruptive behaviors (e.g., wandering, aggressive, and agitated behaviors) among unrestrained residents are summarized in the Table 4-27, Table 4-28, and Table 4-29.

Summary of the results of the aim 3 among the unrestrained residents

There is no mediating effect of pain severity on the relationship between background factors and the frequency of disruptive behaviors in unrestrained residents. The hypothesis that pain severity would mediate the effect of background factors on the frequency of disruptive behaviors in unrestrained residents is not supported.

Summary of Findings among the Unrestrained Residents

The results using data from unrestrained residents are similar to the ones among all the NH residents, except that the overall prevalence of disruptive behaviors is lower in the subsample without restraints. First, the prevalence of wandering decreased from 9% to 5%, aggressive behaviors decreased from 24.4% to 14.2%, and agitated behaviors decreased from 30.4% to 16.9% in the subsample. The hypothesis that disruptive behaviors would be more prevalent among the unrestrained residents is not supported. Second, pain severity is still negatively associated with the frequency of wandering behaviors (OR = .68, p = .000), but positively associated with the frequency of aggressive and agitated behaviors (OR = 1.10, p = .032; OR = 1.11, p = .016; respectively), after controlling for the other background/proximal factors. The hypothesis that pain severity would be significantly associated with increased frequency of wandering behaviors is not supported, but the hypothesis that pain severity would be significantly associated with increased frequency of aggressive or agitated behaviors is supported. Third, there are still no mediating effects of pain severity on the relationship between background factors and disruptive behaviors. The hypothesis that pain severity would mediate the effect of background factors on the frequency of disruptive behaviors is not supported.

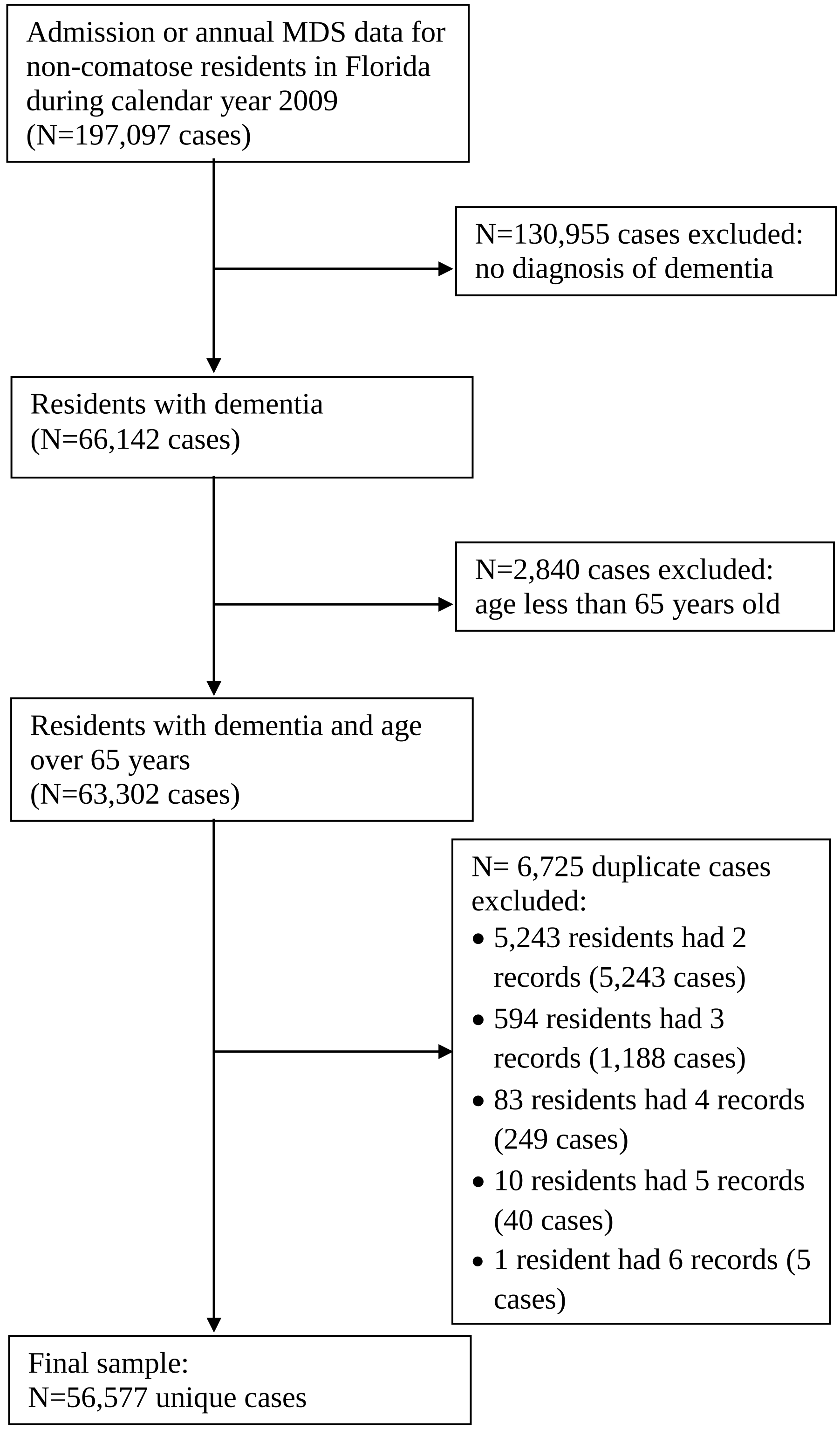

Figure 4-1. Sample selection process

Table 4-1. Sample description: Background factors (N=56,577)

Characteristics	Possible Range	N	n (%)	M (SD)	Actual Range
Age (years)		56,577		84 (7)	65-109
Gender		56,566			
Male			18,265 (32.3)		
Female			38,301 (67.7)		
Marital status		55,920			
Never married			3,994 (7.1)		
Married			16,937 (30.3)		
Widowed			30,038 (53.7)		
Separated			659 (1.2)		
Divorced			4,292 (7.7)		
Education		44,295			
K – 11 grades			10,916 (24.6)		
High school			21,176 (47.8)		
Some college			7,296 (16.5)		
Bachelor’s degree			3,189 (7.2)		
Graduate degree			1,718 (3.9)		
Ethnicity		56,392			
Indian/Asian			291 (.5)		
African American			5,944 (10.5)		
Hispanic			5,791 (10.3)		
Caucasian			44,366 (78.7)		
MDS-Cognitive Performance Scale (MDS-CPS)	0 - 6	56,543			
Intact			3,446 (6.1)		
Borderline intact			3,195 (5.7)		
Mild impairment			9,314 (16.5)		
Moderate impairment			21,657 (38.3)		
Moderate severe impairment			7,650 (13.5)		
Severe impairment			5,980 (10.6)		
Very severe impairment			5,301 (9.4)		
Charlson Comorbidity Index	0 - 37	56,562		3 (2)	1-16
Pressure ulcer	0 - 4	56,576			
None			46,349 (81.9)		
Stage I			4,351 (7.7)		
Stage II			3,307 (5.8)		
Stage III			649 (1.1)		
Stage IV			1,920 (3.4)		
Number of medications		56,576		11 (5)	0 - 90
MDS-ADL impairment score	0 - 28	56,577		19 (6)	0 - 28

Table 4-2. Sample description: Proximal factors (N=56,577)

Characteristics	Possible Range	N	n (%)
MDS-Pain	0 - 3	56,568	
No pain			35,710 (63.1)
Mild pain			15,139 (26.8)
Moderate pain			5,227 (9.2)
Excruciating pain			492 (.9)
Hunger	0 - 1	56,573	
No			56,525 (99.1)
Yes			48 (.1)
Thirst	0 - 1	56,576	
No			56,538 (99.1)
Yes			38 (.1)
Bowel incontinence	0 - 4	56,574	
Continent			20,543 (36.3)
Usually continent			3,405 (6.0)
Occasionally incontinent			3,460 (6.1)
Frequently incontinent			6,476 (11.4)
Incontinent			22,690 (40.1)
Bladder incontinence	0 - 4	56,577	
Continent			16,660 (29.4)
Usually continent			3,490 (6.2)
Occasionally incontinent			4,591 (8.1)
Frequently incontinent			9,501 (16.8)
Incontinent			22,335 (39.5)

Table 4-3. Prevalence of disruptive behaviors among all the subjects (N=56,577)

Characteristics	Possible Range	N	n (%)	M (SD)	Actual Range
Wandering	0 - 3	56,573			
No wandering			51,463 (91.0)		
1-3 days in 7 days			2,637 (4.7)		
4-6 days in 7 days			994 (1.8)		
Wandering daily			1,479 (2.6)		
Aggression	0 - 12	56,572		.54 (1.27)	0 - 12
None			42,764 (75.6)		
Moderate			9,667 (17.1)		
Severe			3,390 (6.0)		
Very severe			751 (1.3)		
Agitation	0 - 7	56,570		.61 (1.12)	0 - 7
0			39,345 (69.6)		
1			7,575 (13.4)		
2			5,075 (9.0)		
3-7			4,575 (8.0)		

Table 4-4. Bivariate analysis between background factors, pain, and disruptive behaviors

Variables	Pain	Wandering	Aggression	Agitation
Cognitive Impairments	r_s = -.219 *p* = .000 N=56,534	r_s = .138 *p* = .000 N=56,540	r_s = .202 *p* = .000 N=56,539	r_s = .280 *p* = .000 N=56,537
Charlson Comorbidity Index	r_s = -.007 *p* = .111 N=56,553	r_s = - .102 *p* = .000 N=56,558	r_s = - .023 *p* = .000 N=56,557	r_s = - .085 *p* = .000 N=56,555
Pressure ulcer	r_s = .116 *p* = .000 N=56,567	r_s = -.094 *p* = .000 N=56,572	r_s = -.031 *p* = .000 N=56,571	r_s = -.036 *p* = .000 N=56,569
Number of medication	r_s = .251 *p* = .000 N=56,567	r_s = - .085 *p* = .000 N=56,572	r_s = - .018 *p* = .000 N=56,571	r_s = - .037 *p* = .000 N=56,569
ADL Impairments	r_s = -.017 *p* = .000 N=56,568	r_s = - .187 *p* = .000 N=56,573	r_s = .044 *p* = .000 N=56,572	r_s = .017 *p* = .000 N=56,570
Age	r_s = -.027 *p* = .000 N=56,568	r_s = - .047 *p* = .000 N=56,573	r_s = - .032 *p* = .000 N=56,572	r_s = - .040 *p* = .000 N=56,570
Gender	*U* = 368,448,792 *p* =.000 N=56,557	*U* = 343,233,726 *p* =.000 N=56,562	*U* = 333,909,726 *p* =.000 N=56,561	*U* = 336,350,737 *p* =.000 N=56,559
Male	Median=.00 M (SD)=.43 (.67)	Median=.00 M (SD)=.18(.59)	Median=.00 M (SD)=.63(1.36)	Median=.00 M (SD)=.67(1.17)
Female	Median=.00 M (SD)=.50(.71)	Median=.00 M (SD)=.15(.56)	Median=.00 M (SD)=.50(1.21)	Median=.00 M (SD)=.58(1.08)
Marital status	*H*(4) = 114.237 *p* = .000 N=55,911	*H*(4) = 41.964 *p* = .000 N=55,916	*H*(4) = 81.886 *p* = .000 N=55,915	*H*(4) = 98.511 *p* = .000 N=55,913
Never married	Median=.00 M (SD)=.37(.64)	Median=.00 M (SD)=.14(.53)	Median=.00 M (SD)=.63(1.35)	Median=.00 M (SD)=.59(1.09)
Married	Median=.00 M (SD)=.49 (.71)	Median=.00 M (SD)=.18(.61)	Median=.00 M (SD)=.58(1.35)	Median=.00 M (SD)=.68(1.19)
Widowed	Median=.00 M (SD)=.49(.70)	Median=.00 M (SD)=.15(.55)	Median=.00 M (SD)=.50(1.20)	Median=.00 M (SD)=.56(1.07)

Table 4-4. Continued

Variables	Pain	Wandering	Aggression	Agitation
Separated	Median=.00 M (SD)=.42(.64)	Median=.00 M (SD)=.20(.64)	Median=.00 M (SD)=.67(1.35)	Median=.00 M (SD)=.70(1.24)
Divorced	Median=.00 M (SD)=.48(.71)	Median=.00 M (SD)=.16(.57)	Median=.00 M (SD)=.58(1.28)	Median=.00 M (SD)=.60(1.10)
Education	r_s = .042 *p* = .000 N = 44,2890	r_s = -.003 *p* = .491 N=44,292	r_s = -.004 *p* = .436 N=44,291	r_s = -.015 *p* = .002 N=44,290
Ethnicity	*H*(3) = 477.957 *p* = .004 N=56,383	*H*(3) = 13.390 *p* = .004 N=56,388	*H*(3) = 36.174 *p* = .000 N=56,387	*H*(3) = 153.789 *p* = .000 N=56,385
Indian/Asian	Median=.00 M (SD)=.36(.68)	Median=.14 M (SD)=.00(.56)	Median=.00 M (SD)=.38(.85)	Median=.00 M (SD)=.46(.90)
African American	Median=.00 M (SD)=.35(.60)	Median=.00 M (SD)=.16(.58)	Median=.00 M (SD)=.59(1.33)	Median=.00 M (SD)=.52(1.05)
Hispanic	Median=.00 M (SD)=.36(.60)	Median=.00 M (SD)=.14(.53)	Median=.00 M (SD)=.44(1.07)	Median=.00 M (SD)=.69(1.12)
Caucasian	Median=.00 M (SD)=.51(.72)	Median=.00 M (SD)=.16(.58)	Median=.00 M (SD)=.55(1.28)	Median=.00 M (SD)=.61(1.12)

r_s: Spearman’s correlation, *U*: Mann-Whitney U score, *H*: Kruskal-Wallis H score

Table 4-5. Bivariate analysis between proximal factors and the frequency of disruptive behaviors

Variables	Wandering	Aggression	Agitation
Pain	r_s = -.090 *p* = .000 N=56,564	r_s = -.038 *p* = .000 N=56,563	r_s = -.043 *p* = .000 N=56,561
Hunger	*U* = 1,435,408 *p* =.160 N=56,569	*U* = 1,653,618.50 *p* =.000 N=56,568	*U* = 1,634,866.50 *p* =.002 N=56,566
No	n/a	Median=.00 M (SD)=.54(1.27)	Median=.60 M (SD)=.60(1.11)
Yes	n/a	Median=.00 M (SD)=.98(1.38)	Median=.00 M (SD)=1.21(1.52)
Thirst	*U* = 977,056 *p* =.052 N=56,572	*U* = 1,102,549.50 *p* =.707 N=56,571	*U* = 1,037,880.50 *p* =.921 N=56,569
No	n/a	n/a	n/a
Yes	n/a	n/a	n/a
Bowel continence	r_s = -.048 *p* = .000 N=56,570	r_s = .112 *p* = .000 N=56,569	r_s = -.088 *p* = .000 N=56,567
Bladder continence	r_s = -.017 *p* = .000 N=56,573	r_s = .113 *p* = .000 N=56,572	r_s = .095 *p* = .000 N=56,570

r_s: Spearman's correlation, *U*: Mann-Whitney U score

Table 4-6. Ordinal logistic regression for the background/proximal factors and the frequency of wandering behaviors (N = 43,676)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.687	.017	.000	0.654, 0.721	1.988
Charlson Comorbidity Index	-.181	.014	.000	-0.207, -0.154	0.834
Pressure ulcer	-.347	.033	.000	-0.412, -0.281	0.707
Number of medications	-.012	.004	.005	-0.021, -0.004	0.988
ADL impairments	-.146	.004	.000	-0.154, -0.139	0.864
Age	-.025	.003	.000	-0.030, -0.020	0.975
Gender (female)	-.339	.041	.000	-0.418, -0.259	0.712
Married status					
Never married	-.417	.079	.000	-0.571, -0.262	0.659
Divorced	-.201	.074	.006	-0.345, -0.056	0.818
Widowed	-.073	.044	.096	-0.159, 0.013	0.930
Separated	.157	.143	.273	-0.124, 0.438	1.170
Married (Reference)	0	.	.		
Education	-.005	.018	.794	-0.041, 0.031	0.995
Race/Ethnicity					
Indian/Asian	-.785	.300	.009	-1.372, -0.198	0.456
African American	-.215	.064	.001	-0.340, -0.089	0.807
Hispanic	-.201	.067	.003	-0.331, -0.070	0.818
Caucasian (Reference)	0	.	.	.	
Proximal factors					
Pain	-.292	.032	.000	-0.354, -0.229	0.747
Bowel incontinence	-.086	.018	.000	-0.122, -0.051	0.918
Bladder incontinence	.139	.018	.000	0.104, 0.174	1.149

CI: confidence interval for B, OR: odds ratio

Table 4-7. Ordinal logistic regression for the background/proximal factors and the frequency of aggressive behaviors (N = 43,671)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.379	.010	.000	0.359, 0.398	1.461
Charlson Comorbidity Index	-.035	.007	.000	-0.049, -0.021	0.966
Pressure ulcer	-.082	.013	.000	-0.107, -0.056	0.921
Number of medications	.018	.003	.000	0.012, 0.023	1.018
ADL impairments	-.038	.003	.000	-0.043, -0.033	0.963
Age	-.010	.002	.000	-0.013, -0.007	0.990
Gender (female)	-.345	.026	.000	-0.397, -0.294	0.708
Married status					
Never married	.215	.047	.000	0.123, 0.307	1.240
Divorced	.238	.046	.000	0.147, 0.329	1.269
Widowed	.070	.029	.015	0.014, 0.126	1.073
Separated	.372	.097	.000	0.181, 0.562	1.451
Married (Reference)	0	.	.		
Education	-.014	.012	.253	-0.037, 0.010	0.986
Race/ethnicity					
Indian/Asian	-.472	.179	.008	-0.822, -0.122	0.624
African American	-.115	.040	.004	-0.193, -0.036	0.891
Hispanic	-.457	.043	.000	-0.541, -0.373	0.633
Caucasian (Reference)	0	.	.		
Proximal factors					
Pain	.045	.017	.010	0.011, 0.078	1.046
Hunger	.906	.314	.004	0.291, 1.521	2.474
Bowel incontinence	.058	.011	.000	0.037, 0.079	1.060
Bladder incontinence	.089	.010	.000	0.070, 0.109	1.093

CI: confidence interval for B, OR: odds ratio

Table 4-8. Ordinal logistic regression for the background/proximal factors and the frequency of agitated behaviors (N = 43,669)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.540	.009	.000	0.521, 0.558	1.716
Charlson Comorbidity Index	-.100	.007	.000	-0.114, -0.086	0.905
Pressure ulcer	-.088	.012	.000	-0.112, -0.064	0.916
Number of medications	.017	.002	.000	0.012, 0.022	1.017
ADL impairments	-.057	.002	.000	-0.062, -0.053	0.945
Age	-.014	.002	.000	-0.017, -0.011	0.986
Gender (female)	-.312	.024	.000	-0.360, -0.265	0.732
Married status					
Never married	-.058	.045	.197	-0.145, 0.030	0.944
Divorced	.039	.043	.375	-0.047, 0.124	1.040
Widowed	-.050	.026	.057	-0.102, 0.001	0.951
Separated	.065	.094	.491	-0.119, 0.249	1.067
Married (Reference)	0	.	.		
Education	-.018	.011	.103	-0.039, 0.004	0.982
Race/ethnicity					
Indian/Asian	-.587	.167	.000	-0.914, -0.260	0.556
African American	-.356	.039	.000	-0.433, -0.279	0.700
Hispanic	.178	.035	.000	0.108, 0.247	1.195
Caucasian (Reference)	0	.	.		
Proximal factors					
Pain	.062	.016	.000	0.031, 0.093	1.064
Hunger	.800	.305	.009	0.201, 1.398	2.226
Thirst	-.285	.403	.480	-1.074, 0.505	0.752
Bowel incontinence	-.001	.010	.883	-0.021, 0.018	0.999
Bladder incontinence	.081	.009	.000	0.063, 0.099	1.084

CI: confidence interval for B, OR: odds ratio

Table 4-9. Ordinal logistic regression for the background/proximal factors and the frequency of wandering behaviors after imputing education (N = 55,709)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.636	.015	.000	0.607, 0.666	1.889
Charlson Comorbidity Index	-.189	.012	.000	-0.212, -0.166	0.828
Pressure ulcer	-.330	.031	.000	-0.391, -0.268	0.719
Number of medications	-.008	.004	.029	-0.016, -0.001	0.992
ADL impairments	-.146	.003	.000	-0.152, -0.140	0.864
Age	-.021	.002	.000	-0.025, -0.016	0.979
Gender (female)	-.301	.036	.000	-0.372, -0.230	0.740
Married status					
Never married	-.434	.068	.000	-0.568, -0.300	0.648
Divorced	-.242	.064	.000	-0.368, -0.117	0.785
Widowed	-.100	.039	.010	-0.176, -0.024	0.905
Separated	.084	.133	.529	-0.177, 0.345	1.088
Married (Reference)	0	.	.		
Education (imputed)	.025	.018	.173	-0.011, 0.061	1.025
Race/ethnicity					
Indian/Asian	-.474	.237	.046	-0.939, -0.009	0.623
African American	-.176	.055	.001	-0.284, -0.068	0.839
Hispanic	-.099	.057	.082	-0.210, 0.013	0.906
Caucasian (Reference)	0	.	.		
Proximal factors					
Pain	-.220	.029	.000	-0.277, -0.164	0.803
Bowel incontinence	-.053	.016	.001	-0.084, -0.021	0.948
Bladder incontinence	.156	.016	.000	0.124, 0.188	1.169

CI: confidence interval for B, OR: odds ratio

Table 4-10. Ordinal logistic regression for the background/proximal factors and the frequency of aggressive behaviors after imputing education (N = 55,704)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.340	.009	.000	0.323, 0.357	1.405
Charlson Comorbidity Index	-.029	.006	.000	-0.041, -0.016	0.971
Pressure ulcer	-.074	.012	.000	-0.098, -0.050	0.929
Number of medications	.018	.002	.000	0.013, 0.022	1.018
ADL impairments	-.041	.002	.000	-0.045, -0.037	0.960
Age	-.008	.001	.000	-0.011, -0.006	0.992
Gender (female)	-.330	.023	.000	-0.376, -0.284	0.719
Married status					
Never married	.205	.041	.000	0.125, 0.285	1.228
Divorced	.195	.040	.000	0.116, 0.274	1.215
Widowed	.052	.025	.042	0.002, 0.102	1.053
Separated	.364	.087	.000	0.193, 0.535	1.439
Married (Reference)	0	.	.		
Education (imputed)	-.013	.012	.283	-0.035, 0.010	0.987
Race/ethnicity					
Indian/Asian	-.335	.145	.021	-0.620, -0.051	0.715
African American	-.115	.034	.001	-0.183, -0.048	0.891
Hispanic	-.331	.036	.000	-0.402, -0.260	0.718
Caucasian (Reference)	0	.	.		
Proximal factors					
Pain	.056	.016	.000	0.025, 0.086	1.058
Hunger	.890	.285	.002	0.332, 1.449	2.435
Bowel incontinence	.070	.010	.000	0.051, 0.089	1.073
Bladder incontinence	.086	.009	.000	0.068, 0.104	1.090

CI: confidence interval for B, OR: odds ratio

Table 4-11. Ordinal logistic regression for the background/proximal factors and the frequency of agitated behaviors after imputing education (N = 55,701)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.505	.008	.000	0.489, 0.521	1.657
Charlson Comorbidity Index	-.103	.006	.000	-0.115, -0.091	0.902
Pressure ulcer	-.074	.011	.000	-0.097, -0.052	0.929
Number of medications	.021	.002	.000	0.016, 0.025	1.021
ADL impairments	-.056	.002	.000	-0.060, -0.052	0.946
Age	-.014	.001	.000	-0.016, -0.011	0.986
Gender (female)	-.281	.022	.000	-0.324, -0.237	0.755
Married status					
Never married	-.088	.039	.026	-0.165, -0.011	0.916
Divorced	-.022	.038	.557	-0.097, 0.052	0.978
Widowed	-.059	.024	.012	-0.105, -0.013	0.943
Separated	.030	.086	.730	-0.139, 0.198	1.030
Married (Reference)	0	.	.		
Education (imputed)	.003	.011	.756	-0.018, 0.025	1.003
Race/ethnicity					
Indian/Asian	-.468	.139	.001	-0.741, -0.195	0.626
African American	-.317	.034	.000	-0.384, -0.251	0.728
Hispanic	.215	.031	.000	0.154, 0.276	1.240
Caucasian (Reference)	0	.	.		
Proximal factors					
Pain	.093	.015	.000	0.064, 0.122	1.097
Hunger	1.078	.272	.000	0.545, 1.610	2.939
Thirst	-.091	.375	.809	-0.827, 0.645	0.913
Bowel incontinence	.009	.009	.298	-0.008, 0.027	1.009
Bladder incontinence	.077	.009	.000	0.061, 0.094	1.080

CI: confidence interval for B, OR: odds ratio

Table 4-12. Mediator effect of pain severity on the relationship between background factors and wandering behaviors

Mediator, Predictor, Outcome	Step	Independent variable	Dependent variable	OR	*p*
Pain, cognitive impairments, wandering	1	Cognitive impairments	Wandering	1.32	.000
	2	Cognitive impairments	Pain	.73	.000
	3	Cognitive impairments	Wandering	1.27	.000
		Pain	Wandering	.64	.000
Pain, CCI, wandering	1	CCI	Wandering	.77	.000
	2	CCI	Pain	1.00	.400
	3	CCI	Wandering	n/a	
		Pain	Wandering	n/a	
Pain, pressure ulcer, wandering	1	Pressure ulcer	Wandering	.54	.000
	2	Pressure ulcer	Pain	1.24	.000
	3	Pressure ulcer	Wandering	.56	.000
		Pain	Wandering	.60	.000
Pain, number of medications, wandering	1	Number of medications	Wandering	.94	.000
	2	Number of medications	Pain	1.12	.000
	3	Number of medications	Wandering	.95	.000
		Pain	Wandering	.62	.000
Pain, ADL impairment, wandering	1	ADL impairments	Wandering	.92	.000
	2	ADL impairments	Pain	1.00	.304
	3	ADL impairments	Wandering	n/a	
		Pain	Wandering	n/a	
Pain, age, wandering	1	Age	Wandering	.98	.000
	2	Age	Pain	.99	.000
	3	Age	Wandering	.98	.000
		Pain	Wandering	.56	.000
Pain, gender, wandering	1	Gender (male)	Wandering	1.24	.000
	2	Gender (male)	Pain	.80	.000
	3	Gender (male)	Wandering	1.20	.000
		Pain	Wandering	.57	.000
Pain, marital status, wandering	1	Marital status (married)	Wandering	1.19	.000
	2	Marital status (married)	Pain	1.06	.002
	3	Marital status (married)	Wandering	1.21	.000
		Pain	Wandering	.57	.000
Pain, education, wandering	1	Education	Wandering	1.00	.855
	2	Education	Pain	n/a	
	3	Education	Wandering	n/a	
		Pain	Wandering	n/a	
Pain, ethnicity, wandering	1	Ethnicity (minority)	Wandering	.89	.001
	2	Ethnicity (minority)	Pain	.62	.000
	3	Ethnicity (minority)	Wandering	.82	.000
		Pain	Wandering	.56	.000

CCI: Charlson Comorbidity Index, OR: odds ratio

Table 4-13. Mediator effect of pain severity on the relationship between background factors and aggressive behaviors

Mediator, Predictor, Outcome	Step	Independent variable	Dependent variable	OR	*p*
Pain, cognitive impairments, aggression	1	Cognitive impairment	Aggression	1.34	.000
	2	Cognitive impairment	Pain	.73	.000
	3	Cognitive impairment	Aggression	1.34	.000
		Pain	Aggression	1.01	.633
Pain, CCI, aggression	1	CCI	Aggression	.97	.000
	2	CCI	Pain	1.00	.400
	3	CCI	Aggression	n/a	
		Pain	Aggression	n/a	
Pain, pressure ulcer, aggression	1	Pressure ulcer	Aggression	.93	.000
	2	Pressure ulcer	Pain	1.24	.000
	3	Pressure ulcer	Aggression	.94	.000
		Pain	Aggression	.89	.000
Pain, number of medications, aggression	1	Number of medications	Aggression	.99	.000
	2	Number of medications	Pain	1.12	.000
	3	Number of medications	Aggression	.99	.005
		Pain	Aggression	.89	.000
Pain, ADL impairment, aggression	1	ADL impairments	Aggression	1.01	.000
	2	ADL impairments	Pain	1.00	.304
	3	ADL impairments	Aggression	n/a	
		Pain	Aggression	n/a	
Pain, age, aggression	1	Age	Aggression	.99	.000
	2	Age	Pain	.99	.000
	3	Age	Aggression	.99	.000
		Pain	Aggression	.88	.000
Pain, gender, aggression	1	Gender (male)	Aggression	1.26	.000
	2	Gender (male)	Pain	.80	.000
	3	Gender (male)	Aggression	1.25	.000
		Pain	Aggression	.89	.000
Pain, marital status, aggression	1	Marital status (married)	Aggression	1.06	.011
	2	Marital status (married)	Pain	1.06	.002
	3	Marital status (married)	Aggression	1.06	.009
		Pain	Aggression	.88	.000
Pain, education, aggression	1	Education	Aggression	1.00	.674
	2	Education	Pain	n/a	
	3	Education	Aggression	n/a	
		Pain	Aggression	n/a	
Pain, ethnicity, aggression	1	Ethnicity (minority)	Aggression	.93	.004
	2	Ethnicity (minority)	Pain	.62	.000
	3	Ethnicity (minority)	Aggression	.91	.000
		Pain	Aggression	.88	.000

CCI: Charlson Comorbidity Index, OR: odds ratio

Table 4-14. Mediator effect of pain severity on the relationship between background factors and agitated behaviors

Mediator, Predictor, Outcome	Step	Independent variable	Dependent variable	OR	*p*
Pain, cognitive impairments, agitation	1	Cognitive impairments	Agitation	1.46	.000
	2	Cognitive impairments	Pain	.73	.000
	3	Cognitive impairments	Agitation	1.47	.000
		Pain	Agitation	1.04	.006
Pain, CCI, agitation	1	CCI	Agitation	.90	.000
	2	CCI	Pain	1.00	.400
	3	CCI	Agitation	n/a	
		Pain	Agitation	n/a	
Pain, pressure ulcer, agitation	1	Pressure ulcer	Agitation	.92	.000
	2	Pressure ulcer	Pain	1.24	.000
	3	Pressure ulcer	Agitation	.93	.000
		Pain	Agitation	.88	.000
Pain, number of medications, agitation	1	Number of medications	Agitation	.98	.000
	2	Number of medications	Pain	1.12	.000
	3	Number of medications	Agitation	.99	.000
		Pain	Agitation	.89	.000
Pain, ADL impairments, agitation	1	ADL impairments	Agitation	1.01	.000
	2	ADL impairments	Pain	1.00	.304
	3	ADL impairments	Agitation	n/a	
		Pain	Agitation	n/a	
Pain, age, agitation	1	Age	Agitation	.99	.000
	2	Age	Pain	.99	.000
	3	Age	Agitation	.99	.000
		Pain	Agitation	.87	.000
Pain, gender, agitation	1	Gender (male)	Agitation	1.19	.000
	2	Gender (male)	Pain	.80	.000
	3	Gender (male)	Agitation	1.18	.000
		Pain	Agitation	.88	.000
Pain, marital status, agitation	1	Marital status (married)	Agitation	1.19	.000
	2	Marital status (married)	Pain	1.06	.002
	3	Marital status (married)	Agitation	1.20	.000
		Pain	Agitation	.87	.000
Pain, education, agitation	1	Education	Agitation	.98	.071
	2	Education	Pain	n/a	
	3	Education	Agitation	n/a	
		Pain	Agitation	n/a	
Pain, ethnicity, agitation	1	Ethnicity (minority)	Agitation	1.04	.081
	2	Ethnicity (minority)	Pain	n/a	
	3	Ethnicity (minority)	Agitation	n/a	
		Pain	Agitation	n/a	

CCI: Charlson Comorbidity Index, OR: odds ratio

Table 4-15. Description of restraints use among 56,577 NH residents with dementia

Restraints Type	Number	Percent
Total restraints use	43,585	77.0
Physical restraints use	15,300	27.0
Bed rails	13,354	23.6
Trunk restraints	1,753	3.1
Restraints chair	784	1.4
Limb restraints	73	0.1
Psychoactive medications use	39,141	69.2
Antidepressant	27,098	47.9
Antipsychotics	15,356	27.1
Antianxiety	14,370	25.4
Hypnotics	6,147	10.9

Some residents had more than one restraint. Therefore, summation of the number of the residents who have a restraint is greater than total number of residents who have restraints.

Table 4-16. Description of subsample without restraints: Background factors (N=12,991)

Characteristics	Possible Range	N	n (%)	M (SD)	Actual Range
Age (years)		12,991		85 (7)	65-109
Gender		12,988			
Male			4,326 (33.3)		
Female			8,662 (66.7)		
Marital status		12,820			
Never married			952 (7.4)		
Married			3,869 (30.2)		
Widowed			6,978 (54.4)		
Separated			134 (1.0)		
Divorced			887 (6.9)		
Education		10,552			
K – 11 grades			2,510 (23.8)		
High school			5,096 (48.3)		
Some college			1,705 (16.2)		
Bachelor's degree			805 (7.6)		
Graduate degree			436 (4.1)		
Ethnicity		12,956			
Indian/Asian			78 (.6)		
African American			1,838 (14.2)		
Hispanic			1,041 (8.0)		
Caucasian			9,999 (77.2)		
MDS-Cognitive Performance Scale (MDS-CPS)	0 - 6	12,981		3.13 (1.65)	0-6
Intact			956 (7.4)		
Borderline intact			843 (6.5)		
Mild impairment			2,498 (19.2)		
Moderate impairment			4,403 (33.9)		
Moderate severe impairment			1,519 (11.7)		
Severe impairment			1,070 (8.2)		
Very severe impairment			1,692 (13.0)		
Charlson Comorbidity Index	0 - 37	12,991		3 (2)	1-13
Pressure ulcer	0 - 4	12,991			
None			10,302 (79.3)		
Stage I			1,066 (8.2)		
Stage II			879 (6.8)		
Stage III			183 (1.4)		
Stage IV			561 (4.3)		
Number of medications		12,991		9 (5)	0 - 90
MDS ADL impairment score	0 - 28	12,991		19 (7)	0 - 28

Table 4-17. Description of subsample without restraints: Proximal factors (N=12,991)

Characteristics	Possible Range	N	n (%)
MDS-Pain	0 - 3	12,986	
No pain			8,432 (64.9)
Mild pain			3,466 (26.7)
Moderate pain			983 (7.6)
Excruciating pain			105 (.8)
Hunger	0, 1	12,989	
No			12,980 (99.9)
Yes			9 (.1)
Thirst	0, 1	12,991	
No			12,985 (100)
Yes			6 (<.0)
Bowel incontinence	0 - 4	12,990	
Continent			4,966 (38.2)
Usually continent			712 (5.5)
Occasionally incontinent			756 (5.8)
Frequently incontinent			1,338 (10.3)
Incontinent			5,218 (40.2)
Bladder incontinence	0 - 4	12,991	
Continent			4,250 (32.7)
Usually continent			767 (5.9)
Occasionally incontinent			994 (7.7)
Frequently incontinent			1,981 (15.2)
Incontinent			4,999 (38.5)

Table 4-18. Prevalence of disruptive behaviors in unrestrained residents (N=12,991)

Characteristics	Possible Range	N	n (%)	M (SD)	Actual Range
Wandering	0 - 3	12,990			
No wandering			12,338 (95.0)		
1-3 days in 7 days			344 (2.6)		
4-6 days in 7 days			137 (1.1)		
Wandering daily			171 (1.3)		
Aggression	0 - 12	12,990		.27 (.83)	0-12
None			11,141 (85.8)		
Moderate (1,2)			1,452 (11.2)		
Severe (3-5)			337 (2.6)		
Very severe (6-12)			60 (.5)		
Agitation	0 - 7	12,989		.29 (.74)	0-7
0			10,788 (83.1)		
1			1,227 (9.4)		
2			606 (4.7)		
3			368 (2.8)		

Table 4-19. Bivariate analysis between background factors, pain, and disruptive behaviors in unrestrained residents

Variables	Pain	Wandering	Aggression	Agitation
Cognitive Impairments	r_s = -.238 p = .000 N=12,976	r_s = .088 p = .000 N=12,980	r_s = .126 p = .000 N=12,980	r_s = .188 p = .000 N=12,979
Charlson Comorbidity Index	r_s = -.020 p = .022 N=12,984	r_s = -.087 p = .000 N=12,988	r_s = -.030 p = .001 N=12,988	r_s = -.068 p = .000 N=12,987
Pressure ulcer	r_s = .130 p = .000 N=12,986	r_s = -.077 p = .000 N=12,990	r_s = -.026 p = .003 N=12,990	r_s = -.040 p = .000 N=12,989
Number of medication	r_s = .248 p = .000 N=12,986	r_s = -.087 p = .000 N=12,990	r_s = -.076 p = .000 N=12,990	r_s = -.084 p = .000 N=12,989
ADL Impairments	r_s = -.046 p = .000 N=12,986	r_s = -.171 p = .000 N=12,990	r_s = .004 p = .634 N=12,990	r_s = -.024 p = .006 N=12,989
Age	r_s = -.026 p = .003 N=12,986	r_s = -.017 p = .052 N=12,990	r_s = .022 p = .011 N=12,990	r_s = .000 p = .958 N=12,989
Gender	U = 19,125,204 p =.017 N=12,983	U = 18,637,022 p =.204 N=12,987	U = 18,547,333.50 p =.127 N=12,987	U = 18,504,319 p =.084 N=12,986
Male	Median=.00 M (SD)=.42(.64)	n/a	n/a	n/a
Female	Median=.00 M (SD)=.46(.68)	n/a	n/a	n/a
Marital status	$H(4)$ = 22.049 p = .000 N=12,815	$H(4)$ = 3.660 p = .454 N=12,819	$H(4)$ = 9.630 p = .047 N=12,819	$H(4)$ = 5.437 p = .245 N=12,818
Never married	Median=.00 M (SD)=.35(.62)	n/a	n/a	n/a
Married	Median=.00 M (SD)=.45(.67)	n/a	n/a	n/a
Widowed	Median=.00 M (SD)=.45(.67)	n/a	n/a	n/a

Table 4-19. Continued

Variables	Pain	Wandering	Aggression	Agitation
Separated	Median=.00 M (SD)=.40(.66)	n/a	n/a	n/a
Divorced	Median=.00 M (SD)=.45(.70)	n/a	n/a	n/a
Education	r_s = .019 *p* = .048 N=10,548	r_s = .006 *p* = .554 N=10,552	r_s = .002 *p* = .814 N=10,552	r_s = .011 *p* = .249 N=10,551
Ethnicity	*H*(3) = 81.434 *p* = .000 N=12,951	*H*(3) = 3.474 *p* = .324 N=12,955	*H*(3) = 9.116 *p* = .028 N=12,955	*H*(3) = 19.044 *p* = .000 N=12,954
Indian/Asian	Median=.00 M (SD)=.42(.80)	n/a	Median=.00 M (SD)=.32(.90)	Median=.00 M (SD)=.32(.73)
African American	Median=.00 M (SD)=.33(.58)	n/a	Median=.00 M (SD)=.25(.85)	Median=.00 M (SD)=.23(.68)
Hispanic	Median=.00 M (SD)=.35(.60)	n/a	Median=.00 M (SD)=.21(.67)	Median=.00 M (SD)=.25(.66)
Caucasian	Median=.00 M (SD)=.47(.69)	n/a	Median=.00 M (SD)=.28(.84)	Median=.00 M (SD)=.30(.76)

r_s: Spearman's correlation, *U*: Mann-Whitney U score, *H*: Kruskal-Wallis H score

Table 4-20. Bivariate analysis between proximal factors and disruptive behaviors in unrestrained residents

Variables	Wandering	Aggression	Agitation
Pain	r_s = -.078 p = .000 N=12,985	r_s = -.031 p = .000 N=12,985	r_s = -.035 p = .000 N=12,984
Hunger	U = 74,886 p =.000 N=12,988	U = 69,559.50 p =.102 N=12,988	U = 69,442.50 p =.133 N=12,987
No	Median=.00 M (SD)=.09(.42)	n/a	n/a
Yes	Median=.00 M (SD)=.56(1.01)	n/a	n/a
Thirst	U = 36,996 p =.573 N=12,990	U = 39,455.50 p =.928 N=12,990	U = 38,353.50 p =.921 N=12,989
No	n/a	n/a	n/a
Yes	n/a	n/a	n/a
Bowel continence	r_s = -.063 p = .000 N=12,989	r_s = .063 p = .000 N=12,989	r_s = .035 p = .000 N=12,988
Bladder continence	r_s = -.030 p = .001 N=12,990	r_s = .062 p = .000 N=12,990	r_s = .044 p = .000 N=12,989

r_s: Spearman's correlation, U: Mann-Whitney U score

Table 4-21. Ordinal logistic regression for the background/proximal factors and the frequency of wandering behaviors in unrestrained residents (N = 10,382)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.674	.046	.000	0.585, 0.764	1.962
Charlson Comorbidity Index	-.217	.039	.000	-0.292, -0.141	0.805
Pressure ulcer	-.256	.083	.002	-0.419, -0.094	0.774
Number of medications	-.034	.013	.009	-0.059, -0.008	0.967
ADL impairments	-.145	.009	.000	-0.163, -0.126	0.865
Age	-.015	.007	.038	-0.028, -0.001	0.985
Gender (female)	-.305	.108	.005	-0.517, -0.093	0.737
Marital status					
Never married	-.624	.227	.006	-1.068, -0.180	0.536
Divorced	-.154	.201	.444	-0.548, 0.240	0.857
Widowed	-.014	.117	.905	-0.244, 0.216	0.986
Separated	.198	.411	.630	-0.607, 1.002	1.219
Married (Reference)	0	.	.		
Education	.048	.047	.312	-0.045, 0.141	1.049
Race/ethnicity					
Indian/Asian	-.330	.744	.657	-1.788, 1.128	0.719
African American	-.040	.156	.797	-0.345, 0.265	0.961
Hispanic	-.091	.202	.651	-0.487, 0.304	0.913
Caucasian (Reference)	0	.	.		
Proximal factors					
Pain	-.385	.096	.000	-0.574, -0.196	0.680
Bowel incontinence	-.164	.049	.001	-0.261, -0.068	0.849
Bladder incontinence	.130	.046	.005	0.039, 0.221	1.139

CI: confidence interval for B, OR: odds ratio

Table 4-22. Ordinal logistic regression for the background and proximal factors and the frequency of aggressive behaviors in unrestrained residents (N = 10,382)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.320	.024	.000	0.272, 0.367	1.377
Charlson Comorbidity Index	-.027	.019	.151	-0.064, 0.010	0.973
Pressure ulcer	-.026	.031	.407	-0.086, 0.035	0.974
Number of medications	-.022	.007	.003	-0.036, -0.007	0.978
ADL impairments	-.051	.006	.000	-0.064, -0.038	0.950
Age	.008	.004	.059	0.000, 0.017	1.008
Gender	-.282	.067	.000	-0.413, -0.151	0.754
Marital status					
Never married	.252	.117	.032	0.022, 0.482	1.287
Divorced	.403	.117	.001	0.173, 0.634	1.496
Widowed	.067	.074	.362	-0.077, 0.212	1.069
Separated	.132	.285	.642	-0.426, 0.690	1.141
Married (Reference)	0	.	.		
Education	.004	.030	.880	-0.053, 0.062	1.004
Race/ethnicity					
Indian/Asian	.079	.361	.827	-0.629, 0.786	1.082
African American	-.276	.096	.004	-0.464, -0.089	0.759
Hispanic	-.475	.126	.000	-0.722, -0.229	0.622
Caucasian (Reference)	0	.	.		
Proximal factors					
Pain	.098	.046	.032	0.008, 0.187	1.103
Bowel incontinence	.086	.028	.002	0.032, 0.141	1.090
Bladder incontinence	.044	.025	.072	-0.004, 0.093	1.045

CI: confidence interval for B, OR: odds ratio

Table 4-23. Ordinal logistic regression for the background and proximal factors and the frequency of agitated behaviors in unrestrained residents (N = 10,381)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.504	.024	.000	0.458, 0.550	1.655
Charlson Comorbidity Index	-.061	.018	.001	-0.096, -0.026	0.941
Pressure ulcer	-.059	.030	.047	-0.117, -0.001	0.943
Number of medications	-.019	.007	.005	-0.032, -0.006	0.981
ADL impairments	-.068	.006	.000	-0.080, -0.057	0.934
Age	.000	.004	.925	-0.008, 0.007	1.000
Gender (female)	-.305	.062	.000	-0.426, -0.184	0.737
Marital status					
Never married	-.026	.112	.815	-0.246, 0.193	0.974
Divorced	.096	.113	.394	-0.125, 0.317	1.101
Widowed	-.029	.067	.667	-0.159, 0.102	0.971
Separated	-.066	.269	.807	-0.594, 0.462	0.936
Married (Reference)	0	.	.		
Education	.030	.027	.270	-0.023, 0.083	1.030
Race/ethnicity					
Indian/Asian	-.119	.354	.738	-0.812, 0.575	0.888
African American	-.328	.091	.000	-0.506, -0.151	0.720
Hispanic	-.234	.108	.030	-0.446, -0.022	0.791
Caucasian (Reference)	0	.	.		
Proximal factors					
Pain	.102	.042	.016	0.019, 0.185	1.107
Bowel incontinence	-.028	.026	.275	-0.078, 0.022	0.972
Bladder incontinence	.057	.023	.013	0.012, 0.102	1.059

CI: confidence interval for B, OR: odds ratio

Table 4-24. Ordinal logistic regression for the background/proximal factors and the frequency of wandering behaviors in unrestrained residents after imputing education (N = 12,774)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.620	.041	.000	0.539, 0.701	1.859
Charlson Comorbidity Index	-.217	.035	.000	-0.284, -0.149	0.805
Pressure ulcer	-.220	.077	.004	-0.371, -0.069	0.803
Number of medications	-.024	.011	.035	-0.046, -0.002	0.976
ADL impairments	-.153	.008	.000	-0.170, -0.137	0.858
Age	-.014	.006	.028	-0.026, -0.001	0.986
Gender (female)	-.208	.099	.036	-0.403, -0.014	0.812
Marital status					
Never married	-.520	.194	.007	-0.901, -0.140	0.595
Divorced	-.145	.177	.414	-0.493, 0.203	0.865
Widowed	-.043	.106	.687	-0.251, 0.165	0.958
Separated	.056	.399	.888	-0.727, 0.839	1.058
Married (Reference)	0	.	.		
Education (imputed)	.092	.047	.051	0.000, 0.184	1.096
Race/ethnicity					
Indian/Asian	-.142	.616	.818	-1.349, 1.066	0.868
African American	-.064	.138	.640	-0.334, 0.205	0.938
Hispanic	-.139	.179	.439	-0.491, 0.213	0.870
Caucasian (Reference)	0	.	.		
Proximal factors					
Pain	-.312	.090	.001	-0.488, -0.136	0.732
Bowel incontinence	-.130	.045	.004	-0.218, -0.042	0.878
Bladder incontinence	.188	.044	.000	0.103, 0.274	1.207

CI: confidence interval for B, OR: odds ratio

Table 4-25. Ordinal logistic regression for the background/proximal factors and the frequency of aggressive behaviors in unrestrained residents after imputing education (N = 12,774)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.260	.022	.000	0.218, 0.302	1.297
Charlson Comorbidity Index	-.017	.016	.299	-0.049, 0.015	0.983
Pressure ulcer	-.018	.029	.543	-0.074, 0.039	0.982
Number of medications	-.027	.007	.000	-0.040, -0.015	0.973
ADL impairments	-.054	.006	.000	-0.065, -0.043	0.947
Age	.009	.004	.013	0.002, 0.017	1.009
Gender (female)	-.288	.061	.000	-0.407, -0.170	0.750
Marital status					
Never married	.193	.105	.067	-0.013, 0.399	1.213
Divorced	.405	.104	.000	0.202, 0.608	1.499
Widowed	.102	.066	.122	-0.027, 0.231	1.107
Separated	.145	.255	.570	-0.355, 0.644	1.156
Married (Reference)	0	.	.		
Education (imputed)	.003	.029	.920	-0.054, 0.060	1.003
Race/ethnicity					
Indian/Asian	.100	.313	.749	-0.513, 0.713	1.105
African American	-.186	.082	.023	-0.346, -0.025	0.830
Hispanic	-.347	.106	.001	-0.554, -0.140	0.707
Caucasian (Reference)	0	.	.		
Proximal factors					
Pain	.094	.043	.028	0.010, 0.177	1.099
Bowel incontinence	.096	.026	.000	0.046, 0.146	1.101
Bladder incontinence	.044	.023	.054	-0.001, 0.090	1.045

CI: confidence interval for B, OR: odds ratio

Table 4-26. Ordinal logistic regression for the background/proximal factors and the frequency of agitated behaviors in unrestrained residents after imputing education (N = 12,773)

Independent Variables	B	SE B	*p*	95% CI	OR
Background factors					
Cognitive impairments	.450	.021	.000	0.409, 0.492	1.568
Charlson Comorbidity Index	-.067	.016	.000	-0.098, -0.035	0.935
Pressure ulcer	-.046	.028	.102	-0.100, 0.009	0.955
Number of medications	-.015	.006	.014	-0.027, -0.003	0.985
ADL impairments	-.068	.005	.000	-0.078, -0.058	0.934
Age	-.002	.004	.572	-0.009, 0.005	0.998
Gender (female)	-.286	.057	.000	-0.397, -0.175	0.751
Marital status					
Never married	-.013	.101	.895	-0.211, 0.184	0.987
Divorced	.114	.101	.258	-0.083, 0.311	1.121
Widowed	-.001	.060	.987	-0.119, 0.118	0.999
Separated	-.129	.253	.611	-0.624, 0.367	0.879
Married (Reference)	0	.	.		
Education (imputed)	.056	.027	.036	0.004, 0.108	1.058
Race/ethnicity					
Indian/Asian	.062	.294	.833	-0.513, 0.637	1.064
African American	-.342	.081	.000	-0.500, -0.184	0.710
Hispanic	-.170	.094	.071	-0.354, 0.015	0.844
Caucasian (Reference)	0	.	.		
Proximal factors					
Pain	.126	.040	.002	0.048, 0.204	1.134
Bowel incontinence	-.012	.024	.624	-0.058, 0.035	0.988
Bladder incontinence	.061	.022	.005	0.019, 0.104	1.063

CI: confidence interval for B, OR: odds ratio

Table 4-27. Mediator effect of pain severity on the relationship between background factors and wandering behaviors in unrestrained residents

Mediator, Predictor, Outcome	Step	Independent variable	Dependent variable	OR	*p*
Pain, cognition, wandering	1	Cognition	Wandering	1.32	.000
	2	Cognition	Pain	.73	.000
	3	Cognition	Wandering	1.27	.000
		Pain	Wandering	.64	.000
Pain, CCI, wandering	1	CCI	Wandering	.77	.000
	2	CCI	Pain	1.00	.400
	3	CCI	Wandering	n/a	
		Pain	Wandering	n/a	
Pain, pressure ulcer, wandering	1	Pressure ulcer	Wandering	.54	.000
	2	Pressure ulcer	Pain	1.24	.000
	3	Pressure ulcer	Wandering	.56	.000
		Pain	Wandering	.60	.000
Pain, number of medications, wandering	1	Number of medications	Wandering	.94	.000
	2	Number of medications	Pain	1.12	.000
	3	Number of medications	Wandering	.95	.000
		Pain	Wandering	.62	.000
Pain, ADL impairments, wandering	1	ADL	Wandering	.92	.000
	2	ADL	Pain	1.00	.304
	3	ADL	Wandering	n/a	
		Pain	Wandering	n/a	
Pain, age, wandering	1	Age	Wandering	.98	.000
	2	Age	Pain	.99	.000
	3	Age	Wandering	.98	.000
		Pain	Wandering	.56	.000
Pain, gender, wandering	1	Gender (male)	Wandering	1.24	.000
	2	Gender (male)	Pain	.80	.000
	3	Gender (male)	Wandering	1.20	.000
		Pain	Wandering	.57	.000
Pain, marital status, wandering	1	Marital status (married)	Wandering	1.19	.000
	2	Marital status (married)	Pain	1.06	.002
	3	Marital status (married)	Wandering	1.21	.000
		Pain	Wandering	.57	.000
Pain, education, wandering	1	Education	Wandering	1.00	.855
	2	Education	Pain	n/a	
	3	Education	Wandering	n/a	
		Pain	Wandering	n/a	
Pain, ethnicity, wandering	1	Ethnicity (minority)	Wandering	.89	.001
	2	Ethnicity (minority)	Pain	.62	.000
	3	Ethnicity (minority)	Wandering	.82	.000
		Ethnicity (minority)	Wandering	.56	.000

CCI: Charlson Comorbidity Index, OR: odds ratio

Table 4-28. Mediator effect of pain severity on the relationship between background factors and aggressive behaviors in unrestrained residents

Mediator, Predictor, Outcome	Step	Independent variable	Dependent variable	OR	*p*
Pain, cognition, aggression	1	Cognition	Aggression	1.34	.000
	2	Cognition	Pain	.73	.000
	3	Cognition	Aggression	1.34	.000
		Pain	Aggression	1.01	.633
Pain, CCI, aggression	1	CCI	Aggression	.97	.000
	2	CCI	Pain	1.00	.400
	3	CCI	Aggression	n/a	
		Pain	Aggression	n/a	
Pain, pressure ulcer, aggression	1	Pressure ulcer	Aggression	.93	.000
	2	Pressure ulcer	Pain	1.24	.000
	3	Pressure ulcer	Aggression	.94	.000
		Pain	Aggression	.89	.000
Pain, number of medications, aggression	1	Number of medications	Aggression	.99	.000
	2	Number of medications	Pain	1.12	.000
	3	Number of medications	Aggression	.99	.005
		Pain	Aggression	.89	.000
Pain, ADL impairments, aggression	1	ADL	Aggression	1.01	.000
	2	ADL	Pain	1.00	.304
	3	ADL	Aggression	n/a	
		Pain	Aggression	n/a	
Pain, age, aggression	1	Age	Aggression	.99	.000
	2	Age	Pain	.99	.000
	3	Age	Aggression	.99	.000
		Pain	Aggression	.88	.000
Pain, gender, aggression	1	Gender (male)	Aggression	1.26	.000
	2	Gender (male)	Pain	.80	.000
	3	Gender (male)	Aggression	1.25	.000
		Pain	Aggression	.89	.000
Pain, marital status, aggression	1	Marital status (married)	Aggression	1.06	.011
	2	Marital status (married)	Pain	1.06	.002
	3	Marital status (married)	Aggression	1.06	.009
		Pain	Aggression	.88	.000
Pain, education, aggression	1	Education	Aggression	1.00	.674
	2	Education	Pain	n/a	
	3	Education	Aggression	n/a	
		Pain	Aggression	n/a	
Pain, ethnicity, aggression	1	Ethnicity (minority)	Aggression	.93	.004
	2	Ethnicity (minority)	Pain	.62	.000
	3	Ethnicity (minority)	Aggression	.91	.000
		Ethnicity (minority)	Aggression	.88	.000

CCI: Charlson Comorbidity Index, OR: odds ratio

Table 4-29. Mediator effect of pain severity on the relationship between background factors and agitated behaviors in unrestrained residents

Mediator, Predictor, Outcome	Step	Independent variable	Dependent variable	OR	*p*
Pain, cognition, agitation	1	Cognition	Agitation	1.46	.000
	2	Cognition	Pain	.73	.000
	3	Cognition	Agitation	1.47	.000
		Pain	Agitation	1.04	.006
Pain, CCI, agitation	1	CCI	Agitation	.90	.000
	2	CCI	Pain	1.00	.400
	3	CCI	Agitation	n/a	
		Pain	Agitation	n/a	
Pain, pressure ulcer, agitation	1	Pressure ulcer	Agitation	.92	.000
	2	Pressure ulcer	Pain	1.24	.000
	3	Pressure ulcer	Agitation	.93	.000
		Pain	Agitation	.88	.000
Pain, number of medications, agitation	1	Number of medications	Agitation	.98	.000
	2	Number of medications	Pain	1.12	.000
	3	Number of medications	Agitation	.99	.000
		Pain	Agitation	.89	.000
Pain, ADL impairments, agitation	1	ADL	Agitation	1.01	.000
	2	ADL	Pain	1.00	.304
	3	ADL	Agitation	n/a	
		Pain	Agitation	n/a	
Pain, age, agitation	1	Age	Agitation	.99	.000
	2	Age	Pain	.99	.000
	3	Age	Agitation	.99	.000
		Pain	Agitation	.87	.000
Pain, gender, agitation	1	Gender (male)	Agitation	1.19	.000
	2	Gender (male)	Pain	.80	.000
	3	Gender (male)	Agitation	1.18	.000
		Pain	Agitation	.88	.000
Pain, marital status, agitation	1	Marital status (married)	Agitation	1.19	.000
	2	Marital status (married)	Pain	1.06	.002
	3	Marital status (married)	Agitation	1.20	.000
		Pain	Agitation	.87	.000
Pain, education, agitation	1	Education	Agitation	.98	.071
	2	Education	Pain	n/a	
	3	Education	Agitation	n/a	
		Pain	Agitation	n/a	
Pain, ethnicity, agitation	1	Ethnicity (minority)	Agitation	1.04	.081
	2	Ethnicity (minority)	Pain	n/a	
	3	Ethnicity (minority)	Agitation	n/a	
		Pain	Agitation	n/a	

CCI: Charlson Comorbidity Index, OR: odds ratio

CHAPTER 5
DISCUSSION AND IMPLICATIONS

Summary of Results

This study examined the relationship between pain severity and the frequency of disruptive behaviors (e.g., wandering, aggressive, and agitated behaviors). Among Florida NH residents with dementia, the prevalence of pain is 37%, and the prevalence of disruptive behaviors is 9 - 30% (wandering behaviors: 9%; aggressive behaviors: 24%; and agitated behaviors: 30%). More severe pain is associated with fewer wandering behaviors, but is associated with more frequent aggressive and agitated behaviors, after controlling for the other background/proximal factors. There are no mediating effects of pain severity on the relationship between any of background factors (e.g., cognitive impairment, comorbidity, pressure ulcer, number of medications, ADL impairment, age, gender, marital status, education, and race/ethnicity) and the frequency of disruptive behaviors. Among the unrestrained NH residents, the results are similar to the ones among all the NH residents, except that the overall prevalence of disruptive behaviors is lower. In the following sections, the findings are discussed in detail.

Prevalence of Pain in Cognitively Impaired Residents

In this study, about one of the third of the NH residents with dementia were reported as experiencing pain. The prevalence of pain in this study is lower than that of the published studies using direct pain assessment, but similar to that of studies using MDS assessment data. A number of studies reported that 50% to 80% of NH residents had pain using complete interview or direct observation of behavioral pain indicators (Black, et al., 2006; Horgas & Dunn, 2001; Jones, et al., 2006; Smalbrugge, et al., 2007; D. Weiner, et al., 1999; Zanocchi, et al., 2008; Zwakhalen, et al., 2009). These rates are lower when MDS assessment data is used (Cohen-Mansfield, 2004), and are consistent with the results of this study (approximately 30%).

In the MDS assessment data, pain items (frequency and intensity) are coded based on self-reports from NH residents and/or facility nursing staff or informal caregivers. Pain assessment using self-report from residents with dementia and/or caregivers who do not have enough training to observe signs of pain may incorrectly describe pain in cognitively impaired residents (Hadjistavropoulos & Craig, 2002; Horgas & Elliott, 2004; Horgas, et al., 2009). PWDs' ability to remember, interpret, and respond to pain is altered so that they are often unable to properly articulate or convey their pain experience. Also, nursing staff or informal caregivers often do not consider behavioral pain indicators when they evaluate pain in cognitively impaired residents, so their self-report can underestimate pain for these residents (Cadogan, Schnelle, Yamamoto-Mitani, Cabrera, & Simmons, 2004; Eritz & Hadjistavropoulos, 2010; Horgas & Dunn, 2001).

There is also a consistent relationship between pain and cognitive status in the literature. In this study, pain is negatively associated with cognitive impairment status (Spearman's correlation = -.219, p =.000). This result is consistent with the findings in the literature that pain is less likely to be reported by cognitively impaired residents than among those who are intact (Cohen-Mansfield, 2004; Horgas, et al., 2009; Sengupta, et al., 2010).

Pain assessment in cognitively impaired adults is challenging because their pain perception and expression is different from those in the cognitively intact (Cohen-Mansfield, 2004; Fisher, et al., 2002; Scherder, et al., 2005). Cognitively impaired residents may have difficulties in remembering their pain, interpreting questions and information, or communicating with others, but usually have no difficulties in demonstrating a number of behaviors indicative of pain, such as facial grimacing, rubbing, restlessness, and moaning (Herr, Coyne, et al., 2006; Horgas, et al., 2009; Warden, et al., 2003). Therefore, a comprehensive pain scale that includes behavioral pain indicators (e.g., facial expressions, verbalizations or vocalizations, body movements, changes in interpersonal interactions, changes in activity patterns or routines, and mental status changes) would better recognize pain in cognitively impaired residents (American Geriatric Society, 2002; Horgas, Nichols, Schapson, & Vietes, 2007).

Prevalence of Disruptive Behaviors in Cognitively Impaired Residents

In this study, about one to three out of 10 NH residents with dementia were reported as expressing disruptive behaviors (e.g., wandering, aggressive, and agitated behaviors). The prevalence of disruptive behaviors in this study is lower than that of the published studies. Several studies reported that 40% to 80% of NH residents had disruptive behaviors using comprehensive caregiver interview or direct observation of behaviors (Ballard, Margallo-Lana, et al., 2001; Brodaty, et al., 2001; Chen, et al., 2000; Holtzer, et al., 2003; Hwang, et al., 1997; Kunik, et al., 2007; Margallo-Lana, et al., 2001; Matsuoka, et al., 2003; Schreiner, 2001; Sink, et al., 2004; Suh, 2004; Wood, et al., 2000).

Random errors and biases by MDS coordinators may be responsible for this low frequency of disruptive behaviors on the MDS assessment data (Bharucha, et al., 2008; Shin & Scherer, 2009). MDS coordinators may receive insufficient training on how to evaluate residents for behavioral symptoms, and have limited contact with the residents. In addition, MDS coordinators may have concerns that a high prevalence of disruptive behaviors might affect their NHs' reputations (Anderson, et al., 2003; Hendrix, et al., 2003). One of the CMS quality indicators, behavioral and emotional patterns, is composed of the prevalence or incidence of these disruptive behaviors.

The Relationship between Pain Severity and Disruptive Behaviors

Most of the published literature suggested that there is a positive relationship between pain and disruptive behaviors (Aalten, et al., 2006; Bartels, et al., 2003; Buffum, et al., 2001; Kiely, et al., 2000; Manfredi, et al., 2003; Norton, et al., 2010; Villanueva, et al., 2003). However, the results of this study suggest that the relationship between pain and disruptive behaviors depends on the type of behaviors examined. The direction of the relationship between these variables depends on whether the disruptive behaviors are accompanied by locomotion behaviors. Pain is positively correlated with disruptive behaviors that do not involve locomotion (e.g., aggression and agitation), but negatively related to disruptive behaviors that are accompanied by locomotion (e.g., wandering). That is, the residents who experience more severe pain are more likely to display aggression and agitation, and less likely to wander.

The finding that pain and aggressive or agitated behaviors are positively linked in NH residents with dementia is consistent with other published reports. Buffum and colleagues (2001) reported that pain was positively related to agitation ($r = .50$, $p = .003$) using a bivariate correlation analysis in 33 Veterans Affairs NH residents with dementia, and Manfredi and colleagues (2003) demonstrated that opioid treatment for pain reduced agitation in 13 NH residents with dementia who were more than 85 years old (mean change in CMAI score: -6.4, 95% CI [-10.96, -1.8]). Both of these studies have small sample size. Thus, the results of this study using a large sample from all the residents with dementia in the state of Florida substantiate the positive relationship between pain and non-locomotive disruptive behaviors from these previous findings.

In contrast, the finding on the relationship between pain and wandering behavior in this study is opposite to the findings presented in the literature review. Kiley and the colleagues (2000) used MDS assessment data from 8,982 NH residents, and reported that NH residents who expressed sadness or pain in MDS assessment data were 65% more likely to develop wandering behavior than their counterparts who did not express sadness or pain using a logistic regression analysis (OR = 1.65, $p = .02$), after controlling for pneumonia, short-term memory, repetitive questions, long-term memory, constipation, antipsychotic medication, ADL impairment, and gender. This dissertation study has several strengths compared to the published study. Our study measured pain more appropriately using the MDS-pain severity scale (Fries, et al., 2001), combining both pain frequency and pain intensity, while Kiley and the collegues (2000) measured pain by a dichotomized expression of sadness or pain. Sadness is not typically considered an indicator of pain, and its inclusion may have confounded pain and depression or mood disorder. Also, the 12 covariates (e.g., cognitive impairments, comorbidity, pressure ulcer, number of medications, ADL impairments, age, gender, marital status, education, ethnicity, bowel incontinence, and bladder incontinence) are controlled in this study based on the NDB model, the prevailing theory that explains disruptive behaviors. However, Kiley and the colleagues controlled only 8 covariates (pneumonia, short-term memory, repetitive questions, long-term memory, constipation, antipsychotic medication, ADL impairment, and gender), and there was no clear theoretical basis for their choice of covariates. Kiley and the colleagues did not control for comorbidity, age, marital status, ethnicity, incontinence, and other factors which may influence the results.

Among the disruptive behaviors studied, disruptive behaviors that are accompanied by locomotion (e.g., wandering) are negatively correlated with pain. Wandering is a locomotion behavior (Algase, et al., 1996; Algase, Yao, et al., 2007), and this movement increases pain (Hadjistavropoulos, LaChapelle, MacLeod, Snider, & Craig, 2000; Horgas, et al., 2009). Therefore, this negative relationship may reflect the fact that residents are reluctant to wander or move around when they have pain.

No Mediating Effect of Pain Severity on the Disruptive Behaviors

In the NDB model, Algase and colleagues (1996) conceptualized pain (a proximal factor) as a mediator of the relationship between background factors and dementia-compromised behaviors, and depicted pain as a mediator in the conceptual map. Background factors are hypothesized to directly affect pain (a proximal factor), and then pain affected dementia-compromised behaviors. However, a mediating effect is not found in this study. The effect of background factors (predictor) on disruptive behaviors (outcome) is not significantly diminished in the presence of pain (mediator) in the regression model. Thus, the results of this study do not support the theoretical relationships posited in the NDB model.

The revised NDB model (Algase, Yao, et al., 2007) posits that pain (a proximal factor) serves as either mediator or moderator in the relationship between background factors and dementia-compromised behaviors. Moderation would indicate that the effect of background factors on disruptive behaviors depends on the level of pain. That is, the relationship between background factors and disruptive behaviors differs between the residents who have a severe pain and the ones who do not have. For example, for mildly or moderately cognitively impaired residents, there is no effect of pain on disruptive behaviors; however, for severely cognitively impaired residents, residents with severe pain have more frequent disruptive behaviors than residents without pain.

Restraints Use on NH Residents with Dementia

Conceptually, it only makes sense to investigate influences on disruptive behaviors among residents who are able to display such behaviors; that is, those who are not restrained. Thus, the analyses were repeated in this subsample. In contrast to the hypothesis that unrestrained residents would display more frequent disruptive behaviors, these residents exhibited approximately 50% less frequent disruptive behaviors. The prevalence of wandering decreased from 9% to 5%, aggressive behaviors decreased from 24.4% to 14.2%, and agitated behaviors decreased from 30.4% to 16.9% in the subsample. The decrease of disruptive behaviors among unrestrained residents may reflect that restraints are still often used as a tool to manage disruptive behaviors.

We can speculate that if residents display disruptive behaviors, they are restrained; otherwise, they aren't restrained. Therefore, unrestrained residents had less frequent disruptive behavior. Also, in this study, residents with disruptive behaviors are significantly more likely to be restrained than those without disruptive behaviors (wandering: $\chi^2 = 330.56$, df =1, $p = .000$; aggression: $\chi^2 = 945.74$, df =1, $p = .000$; agitation: $\chi^2 = 1451.91$, df =1, $p = .000$).

The decreased prevalence of disruptive behaviors in unrestrained residents did not essentially change the statistical results. Pain severity is still positively associated with the frequency of disruptive behaviors except wandering behaviors, and does not mediate the relationship between background factors and disruptive behaviors.

There is a high prevalence of restraint use in this study. Almost 80% residents with dementia were restrained physically or chemically: physical restraints (e.g., trunk restraints, limb restraints, restraint chair, and bed rails) are used in 27%, and psychoactive medications (e.g., antipsychotics, antianxiety, antidepressant, and hypnotics) are used in 69% of NH residents with dementia. This finding is consistent with the published literature. The published studies reported that physical restraints were used in about 30% to 70% of NH residents with dementia (Bartels, et al., 2003; Kirkevold, et al., 2003), and psychoactive medications were used in 50% to 75% of these residents (Petek-Ster & Cedilnik-Gorup, 2011; Richter, et al., in press; Tjia, et al., 2010).

Restraints have many side effects, such as increased risk of stroke, death, and so forth (Capezuti, et al., 2002; Gastmans & Milisen, 2006; Huabin, et al., 2011; Schneider, et al., 2005; Sink, et al., 2005). The appropriate management of pain can be used to reduce the use of restraints because pain severity is positively correlated with more frequent disruptive behaviors.

Limitations

Several limitations of this study should be noted. First, this study is inherently limited by secondary analysis of federally mandated MDS assessment data, which contains critical information for CMS certification of all Medicaid- or Medicare-certified NHs. MDS assessment data may have some variability due to different styles and skills of MDS coordinators in each facility, and MDS coordinators might underreport pain or disruptive behaviors because of their belief that a high prevalence of pain or disruptive behaviors might elicit more attention from the CMS survey team during their annual visits. This would affect the certification or financial support from Medicaid and Medicare (Schnelle, Wood, Schnelle, & Simmons, 2001).

Second, the role of pain medications is not considered in this study. Pain medications are usually given when nursing staff note residents' pain. In the MDS assessment data, pain is measured at the highest level during the last 7 days, and behavioral symptoms are measured as the frequency in the last 7 days. The highest level of pain could have been managed by pain medications during the last 7 days, but it is not possible to discern this in the MDS assessment data. However, similar to our study, most of the literature reported the relationship between highest level of pain and the frequency of behavioral symptoms during the observation period without controlling for pain medications (Bartels, et al., 2003; Buffum, et al., 2001; Kiely, et al., 2000; Leonard, et al., 2006; Norton, et al., 2010; Villanueva, et al., 2003).

Third, this study design is descriptive and cross-sectional. As such, this study is not able to examine causal relationships between pain and disruptive behaviors.

Fourth, some variables in the MDS assessment data are dichotomous or ordinal measurements with small ranges so they cannot describe the relative magnitude of the differences. For example, hunger and thirst in MDS assessment data are given dichotomous categorical measurements, and are very positively skewed (prevalence of hunger and thirst: 0.1%). Therefore, these variables are not included in some analyses. Also, pain and wandering are measured as an ordinal format with four levels. If these were measured as continuous format, the outcomes might be more informative.

Fifth, the Charlson Comorbidity Index (CCI), computed from 19 diagnosed medical conditions, provided a limited representation of residents' health status in our study. Six conditions (connective tissue disease, peptic ulcer disease, leukemia, lymphoma, moderate or severe liver disease, and metastatic solid tumor) had to be identified using ICD-9 codes in the "MDS-other diagnoses" item, but these conditions weren't found in most of the MDS data. Therefore, the possible range of CCI is 0 to 37, but actual range of CCI in our study is restricted (Range = 0 to 16).

Sixth, the partial mediation effects were not estimated in this study. The dependent variables were not continuous format and path coefficients are not b-weights of multiple regression. Therefore, we used traditional full mediating effect model and examined whether pain fully mediated the relationship between background factors and disruptive behaviors.

Finally, the NDB model was adapted to guide this study, but this study did not include all the variables in the NDB model. In particular, the relationship between social/physical environmental factors of the NH facilities and disruptive behaviors was not examined (e.g., social interaction, staff mix and ratio, ambiance, crowding, complexity, and ambient conditions). Therefore, the variance of disruptive behaviors which can be explained by background and proximal factors in this study was relatively small (Nagelkerke R-square: wandering 19%, aggression 8.2%, and agitation 13%).

Implications

Implications for Nursing Practice

Pain severity can contribute to disruptive behaviors in residents with dementia (American Geriatric Society, 2002; Bartels, et al., 2003; Buffum, et al., 2001; Horgas & Elliott, 2004; Kiely, et al., 2000; Norton, et al., 2010; Shega, Hougham, Stocking, Cox-Hayley, & Sachs, 2005; Snow, et al., 2009; Villanueva, et al., 2003; Zieber, Hagen, Armstrong-Esther, & Aho, 2005). Health care providers should consider pain as a potential cause of disruptive behaviors, especially disruptive behaviors which are not related to locomotion. A comprehensive pain assessment, which includes behaviors indicative of pain, should be used to assess pain in residents with cognitive impairments. Currently, some pain measures, such as the Assessment of Discomfort in Dementia protocol (Kovach, Weissman, Griffie, Matson, & Muchka, 1999), Dolopus II (Pautex, Herrmann, Michon, Giannakopoulos, & Gold, 2007), Pain Assessment Checklist for Seniors with Limited Ability to Communicate (Fuchs-Lacelle & Hadjistavropoulos, 2004), includes behavioral pain indicators. However, these pain assessment tools are not widely used because of the difficulty of training and scoring these pain measures, or limited psychometric evidence (Herr, Bjoro, & Decker, 2006). A thorough pain measurement tool, which is easy to administer and has strong psychometric evidences, is needed.

Appropriate pain management could help decrease disruptive behaviors and consequently reduce extra costs brought about by the need for constant supervision and the use of other resources, including physical and chemical restraints (Allen-Burge, et al., 1999; Kiely, et al., 2000; Norton, et al., 2010). For example, scheduled pain medications, instead of as-needed antipsychotics or antianxiety medications, would be a better option to manage disruptive behaviors (Elliott & Horgas, 2009; Manfredi, et al., 2003; Reynolds, et al., 2008).

Implications for Theory

The NDB model was adapted to guide this study. The study purpose is not to validate all the propositions in the NDB model, but to explore the specific relationship between pain and disruptive behaviors using that model. The NDB model hypothesizes that there are two main constructs that predict disruptive behaviors: background factors and proximal factors. The model also posits that both background and proximal factors interact or combine in some sequence to produce NDBs (Algase, Yao, et al., 2007).

We tested the hypotheses that pain is positively related to disruptive behaviors and pain mediates the relationship between background factors and disruptive behaviors, which were deduced from one of propositions in the NDB model. We found that there are positive relationships between pain and disruptive behaviors except wandering behaviors, but did not find a mediating effect of pain on the relationship between background factors and disruptive behaviors. One can hypothesize that pain moderates the relationship between background factors and disruptive behaviors using the other proposition (pain as a moderator) in the revised NDB model. This will be tested in future research.

Implications for Future Research

Findings from this study can be a foundation for future research. First, studies using specialized in-depth measures and prospective design are needed to validate these individual-based findings. The Pain Assessment in Advanced Dementia (PAINAD) (Warden, et al., 2003), the Revised Algase Wandering Scale-Long-Term Care version (RAWS-LTC) (Algase, Beattie, et al., 2004) and the Cohen-Mansfield Agitation Inventory (Cohen-Mansfield & Billig, 1986) are easy to administer and require little training. Also, randomized controlled trials (RCTs) can be used to compare comprehensive pain management and usual pain management with regard to the frequency of disruptive behaviors. This type of study can provide evidence for causal relationships between pain management and disruptive behaviors and support changes in clinical practice.

Second, more expanded studies could be investigated using MDS assessment data. For instance, the role of pain medications on disruptive behaviors warrants investigation (Horgas, et al., 2009). This can be studied using MDS data and medication profile data. Also, we can examine the moderating effect of pain on the relationship between background factors and disruptive behaviors. In addition, we can develop a comprehensive pain assessment measure using MDS-items that includes six behavioral pain indicators (e.g., facial expressions, verbalizations or vocalizations, body movements, changes in interpersonal interactions, changes in activity patterns or routines, and mental status changes) in the American Geriatrics Society guidelines for pain (2002). These efforts will facilitate the use of MDS assessment data, since the MDS was intended, in part, as a tool for behavioral research in NH residents.

Third, future research would include the longitudinal MDS assessment data to examine trends over time. The longitudinal nature of MDS assessment data, collected every three months or more often, provides an opportunity to describe change over time, lagged relationships or longitudinal relationships, and facilitates the use of more powerful statistical analysis techniques to describe both within- and between-person changes (Meyers, et al., 2006).

Furthermore, future studies should include measurements of social and physical environmental factors of disruptive behaviors in NH residents with dementia (e.g., staff mix and ratio, ambiance, crowding, complexity, ambient conditions). These domains are one of the proximal factors of disruptive behaviors (Algase, et al., 1996; Algase, Yao, et al., 2007), and the inclusion of these factors may shed more light on the ways in which NH residents express pain through disruptive behaviors.

Conclusion

In conclusion, pain exacerbated disruptive behaviors that are not locomotion-based. In order to reduce these disruptive behaviors, which can lead to use of restraints, their underlying causes, such as pain, should be investigated and well managed. However, pain assessment in cognitively impaired residents can be challenging. Pain assessment based on self-report from residents or nursing staff, is not a reliable assessment method in cognitively impaired adults.

Comprehensive pain assessment that includes behavioral pain indicators should be developed further, and pain should be well controlled to reduce these problematic disruptive behaviors.

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BIOGRAPHICAL SKETCH

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