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Predictors of Cognitive Function Among Cognitively Impaired Older African Americans Living in Congregate Residential Settings

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Predictors of Cognitive Function Among Cognitively Impaired Older African
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Abstract

The purpose of this secondary data analysis was to identify potential psychosocial predictors of cognition, including social support, depression, and functional activity, among older African Americans, $\geq$ 65 years, with a diagnosis of Alzheimer's disease and living in congregate residential settings. Guided by the main effect model of social support, this study used existing data from the National Alzheimer's Coordinating Center Uniform Data Set, an NIH-funded multicenter study. Results showed that on average, the participants (n=56) were 81.7 years of age with 13.8 years of education. All, but six, were married. Bivariate Pearson correlations indicate a moderately strong negative relationship between frequency of phone calls and functional activities (r= -.46, p<.01). On the other hand, there is a strong positive relationship between frequency of phone calls and cognition (r=.46, p<.05). For functional activity, there was a strong inverse relationship between IADLs and level of cognition (r= -.66, p<.01). Further results on hierarchical multiple regression suggest that the extent of social support $F(9,46)$=4.16, p<.01, R^2=.44, adjusted R^2=.33, and level of functional activity $F(8,47)$=8.47, p<.01, R^2=.58, adjusted R^2=.51 predicted level of cognition. Results of model testing suggest that social support explained 44% of the variance for level of cognition, while functional activity accounted for 58% of the variance for level of cognition. Results of the study have implications for future research, nursing practice, and policy that can benefit this population and their informal caregivers. Future research should consider the type of support and level of satisfaction and further investigate which functional activity items are greatly affected as the disease progresses to create culturally-tailored interventions.

Keywords: Older African Americans, social support, cognition, Alzheimer's disease

Chapter 1

Introduction

The rapid growth of the aging population has changed the global demographic profile. The number of worldwide older people (≥ 65 years) is projected to increase up to one billion in the year 2030 (Povova et al., 2012; Qiu, Kivipelto, & von Strauss, 2009; U.S. Department of Health and Human Services, Administration on Aging [USDHHS, AoA], 2014). In the United States (US), the number of individuals in the older population increased by 28%, from 36.2 million in 2004 to 46.2 million in 2014 (USDHHS, AoA, 2015). Currently, about one in every seven (14.5%) of the US population is an older adult (USDHHS, AoA, 2015). The older adult population in the United States is projected to reach approximately 98 million in 2060 (USDHHS, AoA, 2015).

The same trend is observed among ethnic minority older adults. The number of ethnic minorities increased from 6.5 in 2004 (18% of the older adult population) to 10 million (22%) in 2014, and this population will continue to grow in the next decade to approximately 21.1 million in 2030 (28%). Among them, older African Americans (OAAs) constitute the largest segment of this population (9% out of 22% minority population), followed by older adults with Hispanic origin (8%; Beach et al., 2005; USDHHS, AoA, 2015). The non-Hispanic black population also comprises the second highest percentage (14%) of nursing home users.

In 2014, there were 15,600 registered nursing homes in the United States with 1.4 million residents of which approximately 50.4% were diagnosed with Alzheimer's disease (AD) and other types of dementia (Harris-Kojetin et al., 2016). Since aging itself is the greatest risk factor for developing AD, the prevalence of cognitive decline due to

AD increases as individuals become older (Barnes & Bennett, 2014; Povova et al., 2012; Qiu, Kivipelto, & von Strauss, 2009). An increase in the older population also means more people will experience the debilitating symptoms of age-related cognitive impairment due to AD (Howden & Meyer, 2011; Seidl et al., 2011).

Cognitive impairment due to AD has been recognized as a major public health problem in both developed and developing countries as AD is the most common unchangeable cause of dementia (Deary et al., 2009; Hall et al., 2009; Hendrie et al., 2001; Katz et al., 2012). It is a challenge to the health care system of the country as it accounts for higher health care costs. Some studies have identified psychosocial factors, including the extent of social support, extent of depression, and the level of functional activities as modifiable predictive factors for late-life cognitive decline and/or depression in older adults, but results were mixed (Barnes & Bennett, 2014; Barnes, De Leon, Wilson, Bienias, & Evans, 2004; Brenowitz et al., 2014; Shouse, Rowe, & Mast, 2013). There is a lack of evidence for how psychosocial factors may shape the cognitive process in persons with mild AD and mild cognitive impairment (MCI) enrolled in Alzheimer's disease centers (ADCs), particularly OAAs living in congregate residential settings. Common congregate residential settings for older adults include the skilled nursing home, adult day services center, home health agency, hospice, assisted living, residential care community, independent living, and retirement community (Harris-Kojetin et al., 2016; Tennessee Health Care Association, n.d.). They provide a variety of assistance/services for long-term medical and personal care to individuals who are unable to manage independently in the community and in need of assistance with activities of daily living (Harris-Kojetin et al., 2016).

        This study used a secondary data of analysis to specifically focus on how the three

psychosocial factors (the extent of social support, the extent of depression, and the level

of functional activities) may shape the level of cognition among OAA residents in

congregate residential settings (e.g., nursing homes), living with AD (Hassenstab et al.,

2015; Morris et al., 2006; Weintraub et al., 2009). In addition, other risk factors

(covariates) for AD and related to cognitive impairment, such as age, gender, level of

education, and presence of comorbidity, were controlled for each analysis in the study.

Background and Significance of the Problem

        There are over 5 million Americans living with AD in the US (Alzheimer's

Association, 2015; Barnes & Bennett, 2014). It is the most common cause of dementia

(Hsiung et al., 2008), a progressive and irreversible deterioration of cognitive

functioning, accounting for 60% to 80% of the cases in the country (Alzheimer's

Association, 2015; Deary et al., 2009; Missouri Foundation for Health, 2014). Cognitive

impairment due to AD is the sixth leading cause of mortality in the general population

and the fifth leading cause of death for older adults in the US (Alzheimer's Association,

2012, 2014).

        The public health impact of cognitive impairment due to AD is a growing concern

as the aging population continues to increase (Park, O'Connell, & Thomson, 2003). It is a

considerable burden on the individual, family, and community level (Park et al., 2003;

Rait et al., 2005) and brings serious challenges to the country's healthcare system. The

estimated healthcare cost of cognitive impairment due to AD is $172 billion per year

(Reitz, Brayne, & Mayeux, 2011), which has huge implications for the country's

healthcare costs (Park et al., 2003). In 2015, the estimated worldwide cost of dementia was $818 billion (Prince et al., 2015).

Research has shown that both biological and psychosocial factors play an important role in the level of cognition in older adults. Presented in the next section is an extensive review of the literature on all possible biological and psychosocial factors leading to cognitive impairment. In addition, other risk factors for AD and related to cognitive impairment, such as age, gender, level of education, and presence of comorbidity will also be presented.

Factors Related to Cognitive Impairment

I. Biological factors. The biological factors associated with the development of cognitive impairment due to AD are the apolipoprotein epsilon 4 (Barnes & Bennett, 2014), hippocampal shrinking (American Academy of Neurology [AAN], 2009; Schuff et al., 2009), ABCA7 gene (Barnes & Bennett, 2014), breast cancer factor 1 gene (Suberbielle et al., 2015), plasma interleukin 6 (Economos et al., 2013), and neuronal changes that alter neurogenesis (Mu & Gage, 2011).

Apolipoprotein epsilon 4 (APOE 4). The APOE 4 is a cholesterol transport plasma protein that is associated with an increased risk of developing AD (Liu, Kanekiyo, Xu, & Bu, 2013; Logue et al., 2011). It mediates the transport of lipid from cell to cell to maintain the equilibrium within the cell and prevent the occurrence of cardiovascular diseases. The APOE 4 affects and accelerates the deposit of amyloid beta protein in the brain. Thus, the presence of APOE genotype leads to the development of senile plaques that are common in AD. Those with higher levels of APOE 4 have increased risk of AD, both early- and late-onset AD (Liu et al.). Barnes and Bennett

(2014) reported that APOE 4 is consistently greater among African Americans than non-Hispanic Whites. The presence also of APOE 4 is associated with hippocampal shrinkage or volume loss (Schuff et al., 2009).

     ***Hippocampus shrinking*.** Hippocampus is an essential part of the brain for learning and memory (Mu & Gage, 2011). Older adult participants with greater hippocampal volume loss have increased likelihood of having dementia due to AD than participants who are cognitively intact (AAN, 2009; Schuff et al., 2009).

     ***ABCA7 gene*.** The ABCA7 gene belongs to the ATP-binding cassette transporter, which transports various substrates across membranes with the aid of the ATP energy (Hollingworth et al., 2011; Zhao, Yu, Tan, & Tan, 2015). This gene promotes the flow of phospholipids in the cells, maintains the balance of amyloid beta, and enhances phagocytic activities. The ABCA7 is a risk factor for AD, particularly late-onset AD, and are more found among African Americans (Zhao et al.).

     The association of ABCA7 to AD pathology could be traced in several pathways: lipid or cholesterol metabolism, amyloid beta homeostatis, and immune system or phagocytic activities (Bettens, Sleegers, Van Broeckhoven, 2013; Zhao et al., 2015). First, lipid metabolism is essential in performing neuro functions, especially that the brain is rich with lipids; thus, it is vital to maintain its homeostasis. Second, it is important to maintain a balance of amyloid beta since its disequilibrium can lead to deposition of plaques. Third, the regulation of phagocytic activities to eliminate neuronal debris is also a significant function of the ABCA7 to be able to move through plasma membrane to "colocalize with the low-density lipoprotein receptor-related protein 1," (Zhao et al., 2015, p. 1012) and prevent inflammation and plaque buildup.

The level of ABCA7 is increased for people with AD that is also associated with increased amyloid plaque formation. The ABCA7 gene is also related to the clinical dementia rating, which indicates people with greater levels of ABCA7 have an advanced form of cognitive decline (Zhao et al., 2015).

Breast cancer factor 1 (BRCA1) gene. BRCA1 gene, which is linked to breast cancer, is also associated in the development of AD. BRCA1 gene is useful in repairing damaged DNA (Suberbielle et al., 2015). Thus, any alterations affect DNA repair, including cell death. It has been found that patients with AD have lower levels of BRCA1 in the brain. The same is observed using a mouse model. Those with reduced BRCA1 showed higher decline in cognition, reduced neurons, as well as damaged DNA. Further, the presence of amyloid beta reduces BRCA1 levels that impairs DNA repair leading to Alzheimer's disease (McMakin, 2015; Suberbielle et al., 2015), which manifests problems of learning and memory.

Plasma interleukin 6. Interleukin 6 (IL-6) is an inflammatory cytokine that is significantly associated with cognitive decline in AD (Economos et al., 2013; Heyser et al., 1997). More specifically, older adult participants who have IL-6 levels above the median have greater cognitive decline over time compare to participants with IL-6 levels below the median. Economos and colleagues (2013) also reported a significant interaction between IL-6, cognitive decline, and age. Further, Mu and Gage (2011) reported neuronal changes (i.e., neuronal loss, amyloid deposition, and inflammation) alter neurogenesis that has a vital role in AD-pathology.

Neuronal changes. Cognitive impairment due to normal cognitive aging and AD display changes at different areas of the brain. In normal aging, some brain areas are not

reduced, such as the anterior cingulate gyrus and primary visual cortex, while other brain

areas were significantly reduced, such as the dorsolateral and orbital frontal cortex. There

is also a greater reduction in volume in the prefrontal cortex compared to the inferior and

superior temporal cortex. In contrast, in a brain with AD, the parahippocampal cortex is

greatly affected as well as the temporal cortex of the gray matter (Uylings & De

Brabander, 2002).

Further, when it comes to metabolic activity, the subiculum and the dentate gyrus'

metabolic activity were reduced in normal aging. On the one hand, a reduction in the

activity in the entorhinal cortex and the hippocampus (i.e., CA1 field), as well as the

medial temporal lobe volume loss, were observed in cognitive decline due to AD

(Bishop, Lu, & Yankner, 2010).

Neuronal loss occurs in both normal cognitive aging and AD. In the normal aging

process, there are approximately 30% of neurons lost in the dentate hilus and

approximately 50% in the subiculum; both are subregions of the hippocampus. In AD,

there is a greater neuronal loss in the CA1, subiculum, and dentate gyrus. There is also an

increased reduction of neuronal cells in the layer II of the entorhinal cortex and a greater

reduction in brain weight is observed in AD (Uylings & De Brabander, 2002).

II. Psychosocial factors. Major psychosocial factors associated with the

development of cognitive impairment due to AD are social support (Barnes & Bennett,

2014; Imtiaz, Tolppanen, Kivipelto, & Soininen, 2014), depression (Barnes & Bennett,

2014; Imtiaz et al., 2014), and functional activity (Johnson et al., 2007; Marshall et al.,

2015).

Social support and cognition in AD. A number of studies discussed the positive and negative associations between extent of social support and levels of cognition (Barnes, De Leon, Wilson, Bienias, & Evans, 2004; Brenowitz et al., 2014; Clarke et al., 2015; Crooks et al., 2008; Holwerda et al., 2012; James, Wilson, Barnes, & Bennett, 2011; Rovner, Casten, & Leiby, 2016; Wilson et al., 2015; Zahodne, Nowinski, Gershom, & Manly, 2014). All but two of these studies used a longitudinal design. The other two used cross-sectional designs (Crooks et al., 2008; Zahodne et al., 2014).

In studies using longitudinal designs examining the association between social support (e.g., social resources and social activities) and levels of cognition, researchers reported that older adults with greater social resources (Barnes et al., 2004; Crooks et al., 2008), more social activities (James et al., 2011; Rovner, Casten, & Leiby, 2016), and lesser negative social interactions (Wilson et al., 2015) were more likely to have better cognition than those with fewer social resources, infrequent social activity, and more negative social interaction. Barnes and colleagues included both Whites and OAAs in their study exploring the risk factors of AD among adults age ≥ 65-years of age and found an association of having greater social network and engagement with cognitive decline between OAAs and Whites. It is reported that older adults with more social resources have lower cognitive decline. Crooks et al. also conducted a study on the protective role of bigger social network against dementia among community-dwelling women who were ≥ 78 years of age. They found that women with bigger social network have a lower risk of developing dementia, especially those with frequent contact (i.e., daily). While both studies found greater social activity to be associated with lesser cognitive decline among older adults without AD, James et al. included mostly White

participants in their longitudinal-observational study and Rovner et al. focused on African

Americans only. Wilson et al. focused on the association of negative social interaction,

namely rejection, intrusion, failure to provide help, and unsympathetic behaviors, with

risk of mild cognitive impairment and rate of cognitive decline among older adults. They

reported that a higher level of negative social interaction is related to an increased rate of

MCI and cognitive decline.

Researchers have reported that social support is associated with levels of

cognition in regard to community resources (Clarke et al., 2015), feelings of loneliness

and isolation (Holwerda et al. 2012), and emotional support (Zahodne, Nowinski,

Gershom, & Manly, 2014). Clarke et al. included adults ≥ 65 years of age in their study

and found that community resources available within the neighborhood, as well as social

interaction, are related to slower rates of cognitive decline. Holwerda et al. found that

feelings of loneliness and isolation, not being alone, are related to increased risk for

dementia among non-demented community-dwelling older adults (≥ 65 years). In

addition, they found that older adults living alone and not (or no longer) married have a

higher incidence (9.3% vs. 9.2%) of developing dementia than those who are living with

others and/or married (5.6% vs. 5.3%). Zahodne and colleagues (2014) found a positive

association between emotional support and executive functioning in their study among

older adults (≥ 55 years). This indicates that older adults with higher emotional support

have greater executive functioning (i.e., task switching), and processing speed.

In contrast, Brenowitz and colleagues (2014) reported inconsistent associations

between social relationships and MCI among older adults (≥ 55 years). For instance,

widowed participants have a lesser risk of acquiring MCI than married, but not for

divorced/separated or never married participants. The study also showed participants

living with others have a significantly higher risk of developing MCI than those living

with a spouse or partner, but not for those who are living alone.

In summary, social support has been defined as social resources, social activities,

social interactions, social networks, and engagement. Research examining the protective

role of social support in AD has shown that older adults who have greater social

resources (Barnes et al., 2004; Crooks et al., 2008), more social activities (James et al.,

2011; Rovner et al., 2016), and lesser negative social interactions (Wilson et al., 2015)

are more likely to have better cognition. Research assessing the association between

social support and cognition has shown that the availability of community resources

(Clarke et al., 2015) and emotional support (Zahodne et al., 2014) are positively

associated with cognition, whereas cognition is negatively associated with feelings of

loneliness and isolation (Holwerda et al., 2012). However, the measurement of social

support has been inconsistent. Existing findings have been limited to primarily women

(Crooks et al.), White participants (James, Wilson, Barnes, & Bennett), and older adults

without AD (Rovner et al.) or those not residing in a congregate residential setting

(Wilson et al.).

Social support and depression in AD. Studies on the association between extent

of social support and extent of depression have shown mixed results (Chi & Chou, 2011;

Rovner, Casten, & Leiby, 2016; Shouse, Rowe, & Mast, 2013). While some researchers

related less social support and activity to depression (Chi & Chou; Rovner et al.), others

considered the size of social support network as a consequence of depression (Shouse,

Rowe, & Mast).

Chi and Chou (2011) examined the relationship between social support (i.e., social network and quality of social support) and depression among community-dwelling Chinese older adults (> 60 years of age). They found that participants with more and frequent contact with close relatives and friends and those who have seen family members only in a month have higher levels of satisfaction in their social support and lower levels of depression. Rovner, Casten, and Leiby (2016) conducted their study with community-dwelling OAAs, and found cognitive and social activities (e.g., board games and going to church) were related to instrumental activities of daily living (IADLs; i.e., better function) and depression, while physical activities (e.g., walking and dancing) were related to depression. Also, depressive symptoms were commonly reported among participants who have low activity participation in both cognitive and social, and physical activities (Rovner et al.).

In addition, Shouse et al. (2013) revealed that participants' Geriatric Depression Scale and Hopkins Verbal Learning Test-Revised (HVLTR) scores strongly predicted social network size. They found that participants with higher Geriatric Depression Scale (i.e., depression) and lower HVLT-R (i.e., verbal learning and memory ability) scores have smaller network size, and those with lower Dementia Rating Scale – Version 2 (i.e., cognitive function) scores have smaller outer circle networks.

In summary, social support as indicated by network size and frequency of social interactions was found to be associated with depression. However, existing findings have been limited to cross-sectional designs (Chi & Chou, 2001; Rovner, Casten, Leiby, 2016; Shouse, Rowe, & Mast, 2013), primarily to Chinese older adults (Chi & Chou), older adults with amnestic MCI (Rovner et al.), or small sample sizes (Shouse et al.).

Depression and cognition in AD. Research on depression and the level of cognition has shown that older adults who experienced depression have lower cognition (Al Hazzouri et al., 2013; Benoit et al., 2012; Dotson, Beydoun, & Zonderman, 2010; McCutcheon et al., 2016; Rapp et al., 2011; Snowden et al., 2015; Steenland et al., 2012; Zahodne, Nowinski, Gershon, & Manly, 2014). All these studies used a longitudinal design, except for two that used cross-sectional designs (Benoit et al., 2012; Zahodne et al., 2014).

Dotson, Beydoun, and Zonderman (2010) conducted a study among community-dwelling older adults to examine the relationship between number of elevated depressive symptoms (EDS), the risk for MCI, and dementia. Results showed that every episode of EDS was related to a 14% increased risk of developing all-cause dementia. Rapp et al. (2011) compared cognitive decline between demented nursing home residents with and those without a history of depression. They found that residents with dementia but without a history of depression have a rapid cognitive decline while a further increase in cognitive decline was observed among residents with both dementia and depression. Steenland et al. (2012) investigated if late-life depression predicted the transition from normal cognition to MCI and from MCI to AD among older adults. They reported that 'always depressed' participants at follow-up visit had greater risk or progression from normal cognition to MCI while a modest increased risk or progression from MCI to AD compared to participants who are never depressed. Depressed older adults also show poorer cognitive test performance. Al Hazzouri et al. (2013) examined the relationship of long-term cumulative depression with cognitive decline and dementia in a study among older women. Results revealed a strong and independent relationship between long-term

depression and the risk of MCI or dementia and cognitive decline; greater depressive

symptom burden was related to poorer cognitive outcomes and greater cognitive decline.

However, this study only included older women and results could not be generalized to

the older adult population.

McCutcheon et al. (2016) examined the relationship of AD neuropathology and

depression in MCI and mild dementia (dAD) using participants' autopsy data. They

found that depression in early AD is not related to neuropathology and neurofibrillary

tangle pathology, but the history of depression and greater severity of neuropsychiatric

symptoms were related to greater depression. In another study, however, Zahodne et al.

(2014) reported that depressive symptoms were related to slow processing speed among

non-Hispanic White participants and poorer executive function (e.g., task-switching

inhibition) and episodic memory for OAAs. Zahodne et al. also noted that OAAs have

fewer depressive symptoms and lower scores in processing speed than their White

counterparts.

Furthermore, in research examining the prevalence of depression among older

adults across the cognitive continuum, Snowden et al. (2015) found that older adults with

MCI and dementia have 2.5 times higher rates of depression than cognitively intact older

adults. Similarly, Benoit and colleagues (2012) examined the prevalence of apathy and

depression among older participants, ≥ 65 years of age, diagnosed with probable mild AD

based on the National Institute of Neurological and Communicative Disorders and Stroke

(NINCDS) and the Alzheimer's Disease and Related Disorders Association (ADRDA)

criteria. They found that 47.9% of the participants accounted for depression while 41.6%

for apathy. Depression affected 47.8% of the participants with probable mild AD.

Participants with both apathy and depression experienced greater cognitive impairment and limitations in IADL functioning.

In summary, depression is a strong predictor of cognitive decline. However, existing findings have been limited to cross-sectional design (Benoit et al., 2012; Zahodne et al., 2014) or from findings of primarily White (McCutcheon et al.; Rapp et al.) or older female participants (Al Hazzouri et al.), and small sample size of OAAs (Zahodne et al.).

Depression and functional activity. Three longitudinal studies have shown that the extent of older adults' depression influences the level of functional activity (Brown et al., 2013; Palmer et al., 2011; Starkstein, Jorge, Mizrahi, & Robinson, 2005). Starkstein et al. examined the frequency of major and minor depression among older adults with probable AD, and determined the functional and psychopathological impact of depression as well as changes in prevalence at each stage of AD. They found that both major and minor depression have significant relationship with greater functional impairment (i.e., activities of daily living [ADLs]), and more severe social dysfunction and psychopathology than non-depressed participants. They also reported changes in depression symptoms as the severity of AD increases. Palmer et al. examined the relationship between neuropsychiatric symptoms and disease progression among older adults with AD. They found that neuropsychiatric symptoms are related to functional and cognitive decline. More specifically, the study findings suggested that older adults with affective syndrome (i.e., anxiety and depression) at baseline have greater risk (i.e., twofold) in functional decline than without affective syndrome. However, the study focused on Italian older adults. Moreover, Brown et al. evaluated the effect of depression

and cognition on function among older adults with aMCI and non-aMCI. They found a

significant relationship between depression, memory, and processing speed, and

functional impairment. This indicates that older adults with aMCI have more functional

impairment and dependency, while older adults with non-aMCI have "better memory,"

but "poorer executive function."

   Functional activity and cognition in AD. Several longitudinal studies have

shown that older adults with higher functional impairment have increased cognitive

decline due to AD and other dementia subtypes (Marshall et al., 2011; Masters, Morris, &

Roe, 2015; Mayo et al., 2012; Nikolova, Demers, & Beland, 2009; Nourhashemi et al.,

2009; Teng et al., 2010). Marshall et al. found a strong negative relationship between

older adults' executive function (i.e., lower MMSE scores) and IADL, which suggests

more cognitively impaired older adults have higher IADL impairment. Mayo et al. found

that functional status, which was assessed through the performance of IADLs, was an

important predictor of older adults' judgment or problem-solving ability. Nikolova,

Demers, and Beland found that those who experienced abrupt cognitive decline have

impaired IADL and ADL in their study with community-dwelling older adults. In

addition, they found that levels of cognitive decline had greater impact on IADL than

ADL because IADL involved more complicated tasks.

   Moreover, Nourhashemi et al. (2009) compared the AD progression in two groups

of community-dwelling older adults (< 85 and ≥ 85 years). They reported that those who

were aged 85 years and older had greater ADL decline, poorer functional status, and

greater dependency, as compared to those < 85-years of age. Masters et al. (2015)

observed a decline in noncognitive symptoms (i.e., functional, depression, and other

neuropsychiatric symptoms) among cognitively normal participants who both progressed

and did not progress to a Clinical Dementia Rating (CDR) > 0. While older adults with a

CDR > 0 experienced very mild to severe dementia, those who have a CDR = 0 are

considered to have intact cognition. In addition, older adults who progressed to CDR > 0

have a greater functional decline, and developed more depression and other

neuropsychiatric symptoms than those who remained at CDR = 0. Teng et al. (2010)

examined older adults' functional status through evaluating their IADLs to differentiate

MCI from very mild AD. They reported that older adults with very mild AD have higher

FAQ scores, indicating greater functional impairment than older adults with MCI.

Other Factors Related to Cognitive Impairment

There is a recognizable dearth of literature on other factors associated with the

development of cognitive impairment due to AD, and they are education, cognitively

challenging activity (Barnes & Bennett, 2014; Imtiaz, Tolppanen, Kivipelto, & Soininen,

2014), neuroticism, early social adversity (Barnes & Bennett, 2014), alcohol and

smoking, physical activity, and socioeconomic position (Imtiaz, Tolppanen, Kivipelto, &

Soininen, 2014; Johnson et al., 2007; Marshall et al., 2015). Specifically, the level of

education, participation in cognitively challenging activities, the extent of physical

activity, and the level of socioeconomic status have found to be negatively associated

with the degree of cognitive decline in older adults with AD (Barnes & Bennett, 2014;

Imtiaz et al., 2014; Marshall et al., 2015). In addition, the extent of alcohol use and

smoking has shown to be positively associated with the degree of cognitive decline due to

AD (Barnes & Bennett, 2014; Imtiaz et al., 2014).

Operational Definition

The following are the operational definitions of the study variables:

Social support. The extent of social support network refers to older adults' psychosocial experience, which is characterized by structural features. The structural features of social support were measured by frequency of visits and calls older adults received from their social network, including spouses/partners, adult children, relatives, friends, neighbors, and others (Dunst, Trivette, & Hamby, 2006).

Depression. The extent of depression refers to a disorder that displays symptoms that disrupt older adult's cognitive, physical, psychological, and social function. Some of these symptoms include isolation, feelings of sadness, despair, loss of pleasure in doing activities, fatigue, and self-inflicting thoughts, which occur almost every day for at least two weeks (Bressert, 2017; Greenberg, 2012). Depression was measured using a 15-item Geriatric Depression Scale-Short Form (GDS-Short Form). Each item can be completed with "yes" or "no" response options (Masters, Morris, & Roe, 2015) with total scale scores ranging from 0 – 15. In the GDS-Short form, scores of 12-15 suggest severe depression, 9-11 suggest moderate depression, while 5-8 suggest mild depression (Greenberg, 2012).

Functional activity. The level of functional activity refers to the older adults' performance in the IADLs. It was measured using a 10-item FAQ, which was used to assess difficulties in the IADLs as observed by the co-participant (Masters, Morris, & Roe, 2015). There is an increased likelihood for older adults to be diagnosed with AD if they score ≥ 6 in the assessment (Brown, Sneed, Rutherford, Devanand, & Roose, 2014).

Cognition. The level of cognition refers to the cognitive function status among older adults in the areas of orientation, attention, memory, language and visual-spatial skills (Geerlings et al., 2000; Folstein, Folstein, & McHugh, 1975; Tombaugh et al., 1992, 1996) at the time of assessment. While the degree of cognitive decline is the change in older adults' level of cognition between two visits (Nikolova, Demers, & Beland, 2009). More specifically, the degree of cognitive decline is defined as the loss of one or more cognitive function within the five cognitive domains: memory (episodic), attention (working memory), processing speed, executive function, and language (Geerlings et al., 2000; Hassenstab et al., 2015; Folstein, Folstein, & McHugh, 1975; Tombaugh et al., 1992, 1996). It was measured by a 30-point Mini-mental State Examination questionnaire that assesses five areas of cognitive function among older adults (Folstein, Folstein, & McHugh, 1975; Tombaugh et al., 1992, 1996).

There is considerable evidence to suggest that psychosocial factors, including social support, depression, and functional status play a critical role in affecting the level of cognitive function among older adults. However, there had been little information on how these psychosocial factors may shape the level of cognition in OAAs living in the congregate residential settings.

Thus, the purpose of this secondary data analysis was to examine the underlying associations among extent of social support, extent of depression, level of functional activity, and level of cognition in OAAs, ≥ 65 years, with a diagnosis of AD living in the congregate residential settings. Especially this study attempted to 1) identify potential predictors of level of cognition, if any, 2) explore indirect effect on the relationship between psychosocial factors (social support, depression, and functional activity) and the

level of cognition among African American residents of congregate residential settings.

Specifically, this study sought to answer the following research questions:

Research question 1: What are the relationships among social support (measured by frequency of visits and frequency of calls, respectively), depression, functional activity, and level of cognition in African American residents of congregate residential settings?

Research question 2: Do psychosocial factors frequency of visits and frequency of calls, depression, and functional activity predict the level of cognition? Which factor has the strongest predictive power?

Research question 3: How does the extent of depression interact with frequency of visits and frequency of calls, and level of functional activity to affect the level of cognition?

Significance of the Study

This analysis of secondary data research has the potential to make four main contributions in the nursing literature. First, it will support the literature on the importance of integrating psychosocial factors in the plan and delivery of essential care among older adults in the congregate residential settings, to delay cognitive decline since there has been no known cure for AD. Second, it will contribute new knowledge on the major role of social support, such as number of calls and visits received, in the extent of depression, level of functional activity, and level of cognition among older adults in the congregate residential settings. Third, it will examine the strength of the relationship between number of telephone calls and visits to African American older adults' level of cognition. An emphasis on this population is important to meet specific needs that were

not given enough attention in previous studies. Results are expected to benefit the African

American population with AD living in the congregate residential settings, through

improving social activities, functional status, and cognition as well as minimize

depression and caregiving stress and burden to both formal and informal caregivers.

Finally, research in this area supports the importance of considering psychosocial factors

in the implementation of facility-wide programs, policies, and culturally tailored

interventions. Dissemination of study results is the key to implementing these programs

and policies. For instance, facility-wide programs can be initiated through informing the

congregate residential setting administrators on the benefits of building and strengthening

older adults' support system, which includes both formal and informal caregivers. Impact

at the policy-level can be initiated through educating lawmakers during Advocacy Day on

the importance of their support to any residential setting or long-term care facilities

initiative programs that could enhance the well-being, particularly the level of cognition

of older adults. Culturally-tailored interventions can be realized through taking the results

of the study to a higher level, building a research team and using interventions that

integrate the psychosocial factors to daily activities.

Summary

Alzheimer's disease (AD) is a major public health problem in the country. It is a

chronically debilitating disease (Deary et al., 2009), which affects not only the quality of

life of the older adults experiencing the disease, but also their primary caregivers (i.e.,

family and relatives). There has been no cure for AD. Thus, it is vital to consider the

psychosocial factors influencing the illness. Social support, which includes ordinary

interactions and engagement in social activities, relationally regulates older adults'

thought, action, and affect. Its relational influence varies depending on the relationship an older adult has to the caregiver.

Further, there were 27 studies reviewed and included to show the relationship among the psychosocial variables. Twenty-two studies were longitudinal while six were cross-sectional. Out of 27 studies, 14 have OAA subgroup, one with an unspecified group of a minority race, one exclusively focused on OAAs, and another study exclusively included nursing home residents. However, no study that showed the relationship of psychosocial variables was conducted among OAAs with AD living in the congregate residential settings.

This study aimed to examine the predictive ability of social support (measured by frequency of visits, frequency of calls, respectively), extent of depression, and level of functional activity on level of cognition among OAAs with AD residing in the congregate residential settings, using the main effect of social support model.

Chapter 2

Literature Review

This chapter presents a review of theoretical frameworks that have been widely used to study the influence of social support on health outcomes and a review of relevant literature, and conceptualization and measurement of each study variable are described.

Theoretical Frameworks for Studying Social Support

There are four models commonly used to explain the influence of social support on health outcomes, such as depression, anxiety, hostility, psychological well-being, and level of cognition. These are the reserve capacity model, convoy model, stress-buffering model, and the main effect of social support model. Each model is highlighted.

Reserve capacity model. First, the reserve capacity model discusses the associations among psychosocial variables, socioeconomic status (SES), and health outcomes (Gallo, Matthews, Bogart, & Vranceanu, 2005; Gallo, de los Monteros, & Shivpuri, 2009; Zahodne, Nowinski, Gershon, & Manly, 2014). The model postulates that people with lower SES have greater likelihood of being exposed to stress that leads to negative emotions and depletion of psychosocial resources (Gallo, Matthews, Bogart, & Vranceanu, 2005). This results in negative health outcomes because negative experiences deplete reserves (Gallo et al., 2005). The model highlights that individuals with lower SES experience more stress, higher negative emotions (i.e., depression, anxiety, and hostility), and increased reactivity to stress than those with higher SES. The resources affected because of increased stress, negative emotions, reduced reserve, and vulnerability to developing diseases are social support and social integration (i.e., interpersonal), and mastery or control, optimism, and self-esteem (i.e., intrapersonal;

Gallo, de los Monteros, & Shivpuri, 2009). These resources are diminished due to stress

exposure, thus, affecting the biobehavioral pathways of mitigation and coping.

  Convoy model. Second, the convoy model of social relations (Kahn & Antonucci,

1980) focuses on social support as a significant indicator of an individual's well-being as

it directly and indirectly affects the ability to respond to stress. The model and its

foundational theory highlight the role and benefits of social support throughout the

lifespan. The model has five propositions: (a) properties of the person (e.g.,

demographics, personality) and situation (e.g., family and work expectations) determine a

person's need of support; (b) properties of the person and need of support, and properties

of the situation determine the structure of convoy (e.g., size, connectedness, symmetry,

stability); (c) properties of the convoy along with the person and situation determine the

adequacy of received support; (d) personal and situational properties, and adequacy of

support determine life outcomes (e.g., well-being); and (e) convoy structure and

adequacy of support moderate the impact of personal and situational properties on

performance and well-being (pp. 269-271).

  The convoy model, a structural and broad concept, is illustrated in three

concentric circles with the person involved at the center (Antonucci & Akiyama, 1987;

Kahn & Antonucci, 1980). These concentric circles signify a person's convoy of support.

People included in the inner circle have a very close relationship with the focal person

who perceives quality support, regardless of geographical distance. This circle is mostly

comprised of a spouse, family members, and close friends. People in the middle circle are

based on the degree of relationship, but less role-dependent. They are most likely

relatives and friends. Finally, people in the outer circle are role-dependent, which

indicates support may not be maintained in case of role changes. They can be co-workers,

supervisors, and distant relatives. The model is a person-centered network of support that

facilitates coping in times of stressful situations (Kahn & Antonucci, 1980).

    Stress-buffering model. Third, the stress-buffering model postulates that social

relations or social support influences health outcomes within the context of stressful

situations (Cohen & Willis, 1985). The model emphasizes that social relations buffer the

impact of stress on health (e.g., mental, psychological) in two ways. First, the presence of

sufficient social support enables individuals to perceive stressful situations to be less

threatening to health than would be perceived without support. Second, social relations

prevent any physiological and behavioral responses to stress (Kawachi & Berkman,

2001) that could lead to detrimental health outcomes by interfering with the

neuroendocrine response or facilitating healthy behaviors.

    Main effect model. Fourth, the main effect of social support model *(see Figure

1.1)* describes several pathways that social support network influences mental health

outcomes, such as stress reactions, psychological well-being, and psychological distress,

including depression and anxiety (Kawachi & Berkman, 2001). The main effect model

posits that social support network provides beneficial effects to individuals whether under

stress or not. First, a social influence that serves as a normative guidance among members

of the social network will encourage members to practice health-promoting behavior,

such as physical activity (Kawachi & Berkman, 2001). Second, integration in the social

network can directly produce positive psychological states, such as a sense of purpose,

belonging, and self-worth, which may increase motivation for self-care (e.g., physical

activity and lesser alcohol intake) and modulation of neuroendocrine response to stress

(Kawachi & Berkman, 2001).

Figure 1.1. Main effect model of social support and mental health (Cohen, Underwood, & Gottlieb, 2000; Kawachi & Berkman, 2001).

Figure 1.2. Revised conceptual framework for the level of cognition among older adults. This framework was derived from the main effect model of social support and in conjunction with literature review (Cohen, Underwood, & Gottlieb, 2000; Hage, 1972; Kawachi & Berkman, 2001; Shoemaker, Tankard, & Lasorsa, 2004).

Figure 1. **The main effect of social support model and the revised framework for**

this study

Moreover, the main effect of social support model *(see Figure 1.1)* based on the

theory of Relational Regulation helps explain the relationship of social support to health

outcomes, such as level of cognition. Theoretical assumptions for the revised framework

are stated as follows.

1. The higher the extent of social support, the lower the extent of depression

   (Stafford et al., 2011).

2. The lower the extent of depression, the higher the functional activity (Lee &

Lyketsos, 2003).

3. The higher the extent of social support, the higher the level of cognition

(Barnes et al., 2004; Clarke et al., 2015; James et al., 2011; Wilson et al., 2015).

4. The lower the extent of depression, the higher the level of cognition (Dotson,

Beydoun, & Zonderman, 2010; Rapp et al., 2011; Steenland et al., 2012;

Snowden et al. 2015).

5. The lower the level of functional activity, the lower the level of cognition

(Marshall et al., 2011; Mayo et al., 2012; Masters, Morris, & Roe, 2015).

According to the Relational Regulation Theory (RRT), five of its key principles

(Lakey & Orehek, 2011) are useful in explaining the above theoretical assumptions *(see*

Table 1). The relationship on extent of social support and level of cognition can be

explained by the first key principle of the RRT as social support (e.g., calls and in-person

visits) regulates an older adult's affect, action, and thought. The relationship between

extent of social support and extent of depression is supported by the second key principle

of the RRT that highlights the different reactions older adults' displayed based on the

relational influence of the health care providers.

The relationship between level of functional activity and level of cognition can be

explained by the third key principle, which emphasizes relational regulation that happens

in daily meaningful interactions. The relationship on extent of depression and level of

cognition is supported by the fourth key principle that cognitive representations occur in

relational conversations and shared activities. Lastly, the relationship on extent of

depression and level of functional activity can be explained by the sixth key principle of

RRT, which highlights the dynamic process of daily interaction that allows older adults to change in activities and conversations.

Table 1

Theoretical Assumptions of the Revised Model and the RRT Key Principles

Theoretical assumptions	RRT's key principles (Lakey & Orehek, 2011)
Older adults with higher extent of social support have higher level of cognition.	No. 1: Social interaction regulates affect, action, and thought.
Older adults with higher extent of social support have lower extent of depression.	No. 2: Social interaction relationally regulates affect, action, and thought.
Older adults with lower level of functional activity have lower level of cognition.	No. 3: Relational regulation happens in daily ordinary affective social interaction
Older adults with lower extent of depression have higher level of cognition.	No. 4: Relational regulation occurs primarily through conversation and shared activities that elaborate on recipients' cognitive representations of relationships and quasi relationships.
Older adults with lower extent of depression have higher functional activity.	No. 6: Relational regulation is dynamic allowing older adults to change in activities.

Of the four social support models described, the main effect model is selected to explain the associations among psychosocial variables that affect OAAs with AD in the congregate residential settings. The main effect model is the best theoretical fit for the study variables.

Revised Conceptual Framework

To guide the study, a conceptual framework derived from the main effect of social support was used *(see Figure 1.2;* Kawachi & Berkman, 2001). The revised model focuses on how psychosocial factors including social support, depression, and functional activity may influence the level of cognition among OAAs living in the congregate residential settings. The revised conceptual framework hypothesizes:

1. OAAs with higher extent of social support have lower extent of depression (Chi & Chou, 2001; Rovner et al., 2016).

2. OAAs with lower extent of depression have higher level of functional activity (Brown et al., 2013; Palmer et al., 2011; Starkstein, Jorge, Mizrahi, & Robinson, 2005).

3. OAAs with higher extent of social support have higher level of cognition (Barnes, De Leon, Wilson, Bienias, & Evans, 2004; Crooks et al., 2008; James, Wilson, Barnes, & Bennett, 2011; Rovner, Casten, & Leiby, 2016; Wilson et al., 2015).

4. OAAs with higher extent of depression have lower level of cognition (Al Hazzouri et al., 2013; Rapp et al., 2011; Snowden et al., 2015; Steenland et al., 2012; Zahodne, Nowinski, Gershon, & Manly, 2014).

5. OAAs with higher level of functional activity have higher level of cognition (Marshall et al., 2011; Masters, Morris, & Roe, 2015; Mayo et al., 2012; Nikolova, Demers, & Beland, 2009;Teng et al., 2010).

The revised model helps explain the mechanism underlying the relationship between extent of social support, extent of depression, level of functional activity, and

level of cognition among older adults in the congregate residential settings. The revised

model illustrates a unidirectional influential effect of the normative guidance and

relational regulation of social support through interactions with the member of the

network, which protects older adults from experiencing depression, improves functional

status as well as level of cognition (Brown et al., 2013; Rapp et al., 2011; Imtiaz,

Tolppanen, Kivipelto, & Soininen, 2014). Potential mediating variable within the revised

model is the extent of depression.

Review on Relevant Literature

   Alzheimer's Disease and its prevalence in African Americans. Alzheimer's

disease (AD) is the most common cause of dementia (Hsiung, 2008) with 60 to 80% of

the cases (Missouri Foundation for Health, 2014). Dementia due to AD is a progressive

and irreversible deterioration of mental functioning that includes cognitive, emotional

and conative aspects (Alzheimer's Association, 2015). The Global Deterioration Scale or

Reisberg Scale shows that older people diagnosed with early-stage dementia due to AD

experience moderate cognitive decline, begin experiencing difficulties concentrating,

making decisions, completing complex household tasks, and are less active and

motivated in activities (Dementia Care Central, 2013; Duthey, 2013; Jotheeswaran,

Williams & Prince, 2010; Prince, Institute of Psychiatry, King's College London, &

Jackson, 2009).

   The prevalence of AD among ethnic minorities is greater than that among

Caucasians. African Americans, for instance, are twice more likely to have AD than their

Caucasian counterparts (Alzheimer's Association, 2015). Seven out of 15 studies

described the greater prevalence and incidence of AD to African Americans (Ayalon,

2013; Glymour, Kosheleva, Wadley, Weiss, & Manly, 2011; Gurland et al., 1999; Hall et

al., 2009; Hendrie et al., 2001; Katz et al., 2012; Wilson et al., 2010). Ayalon (2013)

evaluated ethnic group differences for concerns, knowledge, and beliefs about AD among

groups of Caucasian, African American, and Latino older adults and found that ethnicity

has a unique contribution to the prevalence of dementia, particularly to African

Americans. Glymour, Kosheleva, Wadley, Weiss, and Manly (2011) compared the

geographic distribution between stroke mortality and dementia mortality among African

American and Caucasian older adults and found that all-cause dementia included as a

contributing cause of death to approximately 13% of death records that included stroke

while AD was listed as a contributing cause to 3% stroke-related deaths. Gurland et al.

(1999) study found that age-specific prevalence and incidence of dementia due to

Alzheimer's was higher in African Americans and Latinos compared to Caucasians. Katz

et al. (2012) found that as age increased, the rate of AD increased for males and females,

both Caucasians and African Americans. Wilson et al. (2010) measured the cognitive

consequences of incident AD in both African American and Caucasian older adults, and

results did not vary by race, sex, or age.

   The classification of Alzheimer's Disease. Cognitive impairment due to AD can

be classified using the National Institute of Neurological and Communicative Disorders

and Stroke and the Alzheimer's disease and Related Disorders Association (NINCDS-

ADRDA), National Institute of Aging – Alzheimer's Association (NIA-AA), Global

Deterioration Scale, and the Diagnostic and Statistical Manual of Mental Disorders

(DSM-5).

First, the NINCDS-ADRDA uses three categories to classify cognitive impairment due to AD: probable AD dementia, possible AD dementia, and definite (probable or possible) AD dementia (McKhann et al., 2011; Petersen, 2004; Reitz, Brayne, & Mayeux, 2011). Probable AD dementia indicates a positive in core clinical dementia criteria with gradual appearance of symptoms, notable worsening of symptoms, and presents symptoms of both amnestic and nonamnestic cognitive impairment. Possible AD dementia indicates positive in core clinical dementia criteria, with either atypical (i.e., abrupt onset or lacks objective assessment) or etiological presentation (e.g., due to cardiovascular and neurological diseases). The definite category (i.e., probable or possible) meets the core clinical criteria and has evidence of the presence of biomarkers for AD (e.g., amyloid beta and CSF tau proteins) (McKhann et al., 2011). The first two categories are commonly used in the clinical setting while the latter are only for research purposes.

Second, the NIA-AA has also three categories for classifying AD: preclinical, mild cognitive impairment (MCI), and Alzheimer's dementia. The preclinical category involves brain changes (e.g., amyloid and nerve cells) with non-evident symptoms. This category is recommended only for research, and uses positron emission tomography and cerebrospinal fluid analysis. The MCI category is marked with memory problems, but do not compromise an older adults' independence. This is also largely used for research. The third category, Alzheimer's dementia, displays symptoms beyond memory loss (Vaughn, 2011).

Third, the Global Deterioration Scale or Reisberg Scale uses seven stages to classify AD and dementia: no cognitive decline (normal), very mild cognitive decline

(forgetfulness), mild cognitive decline (early confusional), moderate cognitive decline (late confusional), moderately severe cognitive decline (early dementia), severe cognitive decline (middle dementia) and very severe cognitive decline (late dementia) (Cavanaugh & Whitbourne, 1999, pp. 311-313).

Finally, the revised DSM-5 has replaced its section on dementia, delirium, and amnestic and other cognitive disorders with "neurocognitive disorders" (NCDs). The NCD is primarily divided into two categories: mild and major NCDs. Mild NCDs refer to any cognitive impairment that does not satisfy the criteria for dementia diagnosis, while major NCDs pertain to any cognitive impairment with dementia (Simpson, 2014). In order for an older adult to be diagnosed with major NCD due to AD, he must have two major cognitive symptoms that include memory problem.

Further, ≥ 65 years older adults are the primary users of long-term care: hospice (94.4%), residential care (92.9), nursing homes (84.9%), home health (82.6%) and adult day service centers (63.7%) (Harris-Kojetin, 2016). Of the three age groups (i.e., 65-74, 75-84, and ≥85 years), it appears that ≥ 85 years are the main long-term care users of the residential care community (52.6%), nursing home (41.6%), and hospice (47.3%), while the 75-84 years are the primary users of the home health agency (31.1%) and adult day service center (27.5%) (p. 36).

When it comes to the percentage of long-term care users with the diagnosis of AD, nursing homes are the highest (50.4%) followed by the hospice (44.7%), while it is least in the adult day service center (29.9%). For depression, nursing homes (48.7%) have the highest long-term care users with depression, followed by the home health agency (37.9%), and least in the hospice (22.9%) (Harris-Kojetin, 2016).

The long-term care also has varied distribution in functional activity, such as bathing, dressing, toileting, walking, transferring in and out of bed, and eating. Nursing homes have the highest users in need of assistance in bathing, dressing, toileting, and eating. Home health agency users rank the second while the lowest are long-term care users from the adult day service center and residential care community (Harris-Kojetin, 2016).

Alzheimer's Disease and nursing home residence. Nursing homes or skilled nursing facility is one of the regulated long-term care service providers in the United States. It provides personal care and supportive services to frail older adults (Harris-Kojetin et al., 2013). Nursing homes also provide assistance to ADLs (e.g., bathing and toileting) and IADLs (e.g., medication management) to achieve and maintain an optimum level of functioning. On a daily basis, nursing homes served an average of 88 residents, which was twice higher the number of service users in the adult day services and residential care communities (Harris-Kojetin et al., 2013).

In 2014, there were 15,600 nursing homes in the United States with 1.4 million residents while there are 50.4% nursing home residents diagnosed with AD and other forms of dementia (Harris-Kojetin et al., 2016). Further, nursing homes have the highest percentage of long-term care service users (62.9%) that used Medicaid as a form of payment (Harris-Kojetin et al., 2016) and have the highest percentage of users diagnosed with AD and other types of dementias (50.4%). In terms of population distribution, nursing homes have the second highest percentage of non-Hispanic black users (14%) (p. 38). The proliferation of home and community-based services, such as assisted living, has affected the nursing home population as these gave more options to older adults.

However, Medicaid users mainly seek nursing home services while Medicare users utilized the assisted living services (Feng et al., 2011).

Although the demographic characteristics of nursing home residents vary, prior research works showed the susceptibility of OAAs to nursing home placement. In a 23-year study of nursing homes in the U.S., results showed oldest old (85 years and older), women, and African Americans have higher risk for nursing home placement (Ness, Ahmed, & Aronow, 2004). Smith et al. (2008) supported these findings indicating that African Americans use nursing homes 14% higher than their white counterparts.

Review on Conceptualization and Measurement of Selected Study Variables

The following sections will discuss the associations among the four major study variables: extent of social support, extent of depression, level of functional activity, and level of cognition.

Conceptualization of social support. Social support is one of the psychosocial factors that represents older adults' psychosocial experience, which is characterized by structural and qualitative features of personal relationships (Antonucci & Akiyama, 1987; Barnes, de Leon, Wilson, Bienias, & Evans, 2004; Zahodne, Nowinski, Gershom, & Manly, 2014). It pertains to both psychological and material resources wherein people benefit from their network, which possesses certain characteristics and functions that improve overall health outcome (Rodriguez & Cohen, 1998).

The concept of social support has emerged in various literature of sociology, psychology, and epidemiology (Cohen & Wills, 1985) as well as other health disciplines (Rodriguez & Cohen, 1998). In the sociological view, social support is defined as a psychological asset (Cassel, 1976), engaging in interaction and being part of a

community with an assumed role (Cohen & Wills, 1985). On the one hand, the

psychological view defined social support not only as a social interaction, but also as

social integration and relational reward (Cohen & Wills, p. 312). More specifically, in

social psychology, social support mainly focused on support from friends, family, and

relatives (Sandstrom & Dunn, 2014). In the epidemiological view, social support has

been associated with mortality, that is, the presence of social support indicates lower

mortality rates (Berkman & Syme, 1979; Cohen & Wills; Hammer, 1983).

In most recent research works, the extent of social support has been defined in

various ways. Six studies presented how the social support concept has evolved. These

studies described social support as social activity, engagement, interaction, network size,

and relationship (Barnes, de Leon, Wilson, Bienias, & Evans, 2004; Brenowitz et al.,

2014; James, Wilson, Barnes, & Bennett, 2011; Rovner et al., 2016; Stafford, 2011;

Wilson et al., 2015; Zahodne et al., 2014). Another study describes social support in

terms of feelings of loneliness (i.e., social attachment) and social isolation (i.e., living

arrangement, marital status, and presence/absence of social support) (Holwerda et al.,

2012).

Further, one study described and measured social support network with older

adults' total number of children, relatives, and friends seen in a month (Clarke et al.,

2015). In this study, social support was measured by the numerical frequency of visits

and calls that older adults receive from their social network (number of visits and calls

per month).

Measures of social support. Measures of social support are classified into

structural or functional categories with degrees of specificity or globality. Structural

measures are described as instruments that assess the existence of support while functional measures assess certain actions or behaviors provided by the support network (Cohen & Wills). For instance, structural measures encompass marital status, presence of friends and family, and being a part of a community while functional measures include instrumental (e.g., ADL assistance), informational (e.g., advice and coping information), and emotional (e.g., empathy and caring) types of support (Gottlieb & Bergen, 2010; Rodriguez & Cohen; Cohen, 2004). Specificity of the measures refers to the degree the instrument assesses a certain structure or function of social support while the globality of the measure pertains to its ability to combine various items on structural or functional support to form a global index (Cohen & Wills). The next section presents different ways of defining social support as well as their corresponding measurements.

Social Provisions Scale (SPS). Robert Weiss (1974) defined the concept of social support through his social provisions model as consisting of six social functions or provisions, which are available from an individual's social network or relationships. These six social functions can be classified as either assistance-related or non-assistance related that can be useful in dealing with stressful events. Assistance-related functions include guidance, which consists of advice from mentors, and reliable alliance, which are usually obtained within the family. Non-assistance related functions include reassurance of worth, opportunity for nurturance, attachment, and social integration. Reassurance of worth involves acknowledgement of self-worth or value. Individuals who are surrounded with supportive people displays more effective coping than those with lesser support since they reinforce the person's value and skills. Opportunity of nurturance pertains to an individual's chance to help others (Cutrona & Russell, 1987). In addition, attachment

refers to emotional closeness (p. 41) where a person feels secure while social integration means being a part of a community or a group (Cutrona & Russell, 1987).

The SPS, developed at UCLA, is used to measure social support or provisions. Originally, the scale consisted of 12 items, but as more research studies were conducted, an additional 12 items were added to enhance the scale's reliability. The SPS version used today is a 24-item measure of social support with six subscales: reliable reliance, attachment, guidance, nurturance, social integration, and reassurance of worth. Item responses are recorded on a 4-point scale, which ranges from "completely true" (4 points) to "not at all true" (1 point; Cutrona, Russell, & Rose, 1986). To illustrate, one of the items for attachment is stated as: "I have close relationships that provide me with a sense of emotional security and well-being" (p. 49). Total scale scores range from 24 to 96, with higher scores indicating greater levels of social support.

The SPS has been used in various populations and among its first was college students at UCLA. The measure's total score has a reliability coefficient between 0.85-0.92 when used with an older adult sample (Cutrona & Russell, 1987). The SPS demonstrates satisfactory construct validity as a measure of overall social support (Cutrona, Russell, & Rose, 1986). Its scores also correlate with other measures of social networks (e.g., number of relationship and frequency of contact) and social relationship (e.g., satisfaction) among older adults (Cutrona & Russell, 1987; Cutrona, Russell, & Rose, 1986).

Some of the advantages of using the SPS are that it: (a) has high internal consistency, (b) measures the functional aspect of social support, and (c) is applicable to various populations. It is widely used among students, teachers, nurses, and the elderly.

However, the SPS shows some discriminant validity issues (Cutrona & Russell, 1987).

These issues were addressed by some researches to assure the effect of social support are

not due to other factors (i.e., confounding or spurious correlation) For instance, a group

of students completed several social support measures to examine if SPS is highly

correlated with these measures. A hierarchical multiple regression analysis was

performed, controlling for the effects of social desirability and psychological distress

variables (e.g., depression, introversion-extroversion, neuroticism, and stress), and found

that SPS is associated with other social support measures (Cutrona & Russell, 1987).

     Sense of Support Scale (SSS). Social support can be defined as one's perception

of support that is attributed to a stable view of the social environment (Dolbier &

Steinhardt, 2010, p. 169) wherein one is accepted and provided with help in times of

crisis. Sense of support is measured using the Sense of Support Scale, a 21-item measure

to assess the availability of perceived support (Dolbier & Steinhardt, 2010; Frank-

Stromborg & Olsen, 2004). It is scored on a 4-point Likert scale (0 = not true at all; 3 =

completely true). Total scale scores range from 0 to 63, with higher scores indicating a

greater perception of support. The revised SSS has an internal consistency Cronbach's

alpha coefficient of 0.86 and a test-retest reliability of 0.91 at $p < .001$ (Dolbier &

Steinhardt, 2010) in a sample of university students. The SSS was also validated for

employees (i.e., corporate and university). Its 17-item measure had an internal

consistency coefficient of 0.87 for corporate employees and 0.84 for university

employees. The SSS demonstrates convergent and divergent validity (Dolbier &

Steinhardt, 2010) as supported by studies conducted among employees and college

students. The measure also demonstrates concurrent validity. It is correlated with other

social support measures, such as the Social Provisions Scale and the Interpersonal

Support Evaluation List.

      One of the revised SSS items is stated as, "There is at least one person I feel a

strong emotional tie with" (p. 175). Although the SSS is a global measure that is

internally consistent, with established concurrent validity, and high test-retest validity, it

does not differentiate various functions of social support.

      Family Support Scale (FSS). Social support can be defined as family members'

perception of available support from their network (Hanley, Tasse, Aman, & Pace 1998).

Possible sources of support include parents, spouse, relatives, and friends (Dunst,

Trivette, & Hamby, 2006).

      Several studies were conducted that identified factors of family social support.

Dunst, Jenkins, and Trivette (1984) conducted a study using the FSS with 139 parents of

preschoolers who were experiencing mental retardation and other types of physical

problems. They identified six social support factors, such as informal kinship, social

organizations, formal kinship, nuclear family, specialized professional services, and

general professional services (p. 72). In addition, Dunst and Trivette (1986) specified five

social support factors previously mentioned, except for nuclear family. While Taylor,

Crowley, and White (as cited in Hanley et al., 1998) conducted a study with 990 families

and derived four new social support factors: familial, spousal, social, and professional.

      The FSS was developed from this prior work. It is an 18-item measure of family

support and functioning. It consists of a 5-point Likert scale, with item responses ranging

from 0 = "not at all helpful" to 4 = "extremely helpful" (Hanley et al., 1998). The items

cover various sources of social support for the family, such as relatives, friends,

neighbors, co-workers, and social organizations (Dunst, Trivette, & Hamby, 2006;

Hanley et al., 1998). The total scale score ranges from 0 to 72. The measure had an

internal consistency Cronbach's alpha coefficient of 0.77 and a test-retest validity

between 0.41 and 0.75 that were earlier findings of Dunst, Jenkins, and Trivette (1984)

from 139 parents. When tested with parents of children enrolled in the Head Start

Program, the measure had a Cronbach's alpha coefficient of 0.85 and a test-retest

reliability of 0.73 for its total score (Hanley et al., 1998). The emphasis of FSS is on

family's social support, particularly to those who are caring developmentally at-risk

children, thus, limiting its usability with other population.

   Social Support Questionnaire (SSQ). The SSQ is a 27-item measure of available

social support, conceptualized as having two basic components: perceived availability

(e.g., number of people) and satisfaction of support (i.e., satisfactory vs. unsatisfactory;

Sarason, Levine, Basham, & Sarason, 1983). Each item assesses the two parts of social

support: "number" and "satisfaction." The first part asks respondents to list a maximum

of nine people they can rely for support and to identify their relationship to the

respondent. An option of "no one" is provided for individuals who identify no particular

sources of support. The second part asks respondents to assess their level of satisfaction

for the support provided by each identified person as rated from 6 (very satisfied) to 0

(very dissatisfied). One of the items is stated as: "Whom can you really count on to listen

to you when you need to talk?" (p. 129). The first part of the SSQ can have a maximum

score of 243 and the second part can have a maximum score of 162. Total scores for both

parts are calculated by dividing the sum scores of the two parts by 27 (Sarason et al.,

1983). Higher scores indicate greater number of supportive people and greater satisfaction with the available support.

College students were among the first study population to complete the SSQ. Results showed the "number" items have inter-item correlations between 0.35 to 0.71, while the internal consistency Cronbach's alpha coefficient was 0.97. Additionally, the inter-item correlations for the "satisfaction" items were between 0.21 to 0.74 and an internal consistency Cronbach's alpha coefficient of 0.94. The test-retest reliability correlations for both parts were 0.90 (SSQ-N) and 0.83 (SSQ-S) (Sarason et al., 1983). The overall measure has a high internal consistency Cronbach's alpha coefficient of 0.97 (Sarason Levine, Basham, & Sarason, 1981, 1983; Sarason, Sarason, Shearin, & Pierce, 1987).

The SSQ was also administered to introductory psychology students to find out its correlation to other social support measures. Results showed both SSQ-N and SSQ-S are significantly correlated, especially among female student participants, with the items in Multiple Adjective Affect Check List, Eysenck Personality Inventory, and Lack of Protection Scale (Sarason et al., 1983). The results suggest that gender needs to be considered in the difference of SSQ scores in relation to other personality variables.

The SSQ was also administered to introductory psychology students to find out the influence of social support in their life events. Findings indicate that student participants who had more social support had higher self-esteem and were more optimistic than their peers with lower social support (Sarason et al., 1983). In other words, students with more social support had more positive experiences in their lives.

Consequently, although the SSQ has high internal consistency and evidenced

stability when administered to students over four weeks, it only calculated social support

based on its two components and did not include other functions of support. It also

assumed that the "number" and "satisfaction" parts of the measure are separate entities of

social support (Sarason et al., 1983).

Frequency of calls and visits. Self-report frequency of calls and visits can be

identified as structural measures of social support, that is, they assess the existence of

support older adults received in the congregate residential settings (Cohen & Wills, 1985)

from their social network. These measures of support are quantitative and structural in

nature, which are best supported by the main effect model of social support (Dolbier &

Steinhardt, 2010). It consisted of six levels, with 6 = most frequent calls and visits (i.e.,

daily) and 1 = least calls and visits received (i.e., once a month).

Relevant research findings. The next section discusses relevant research

findings on the association of extent of social support and level of cognition.

Social support and cognition in AD. A population-based longitudinal study in

Chicago Health and Aging Project for the risk factors of AD among older adults

(N=6,102), ≥ 65 years, examined the relationship between social resources (e.g., social

network and engagement) and cognitive decline. Social engagement is defined by

participation in socially meaningful or productive activity (Barnes, de Leon, Wilson,

Bienias, & Evans, 2004; Glass, De Leon, Marottoli, & Berkman, 1999). The study

measured social engagement using four questions on participation in social and

productive activities: 1) attendance to religious services, 2) visits to museum, 3)

participation in activities outside home, and 4) having a part-time or full-time job (Barnes

et al., 2004). Results showed that older adults with greater social resources are related to lower cognitive decline. The study included both African Americans (81.4%) and Whites (75.1%) older adults. However, it used a limited measure of social engagement that consists of four items only, which might be less culturally sensitive (Barnes, de Leon, Wilson, Bienias, & Evans, 2004).

The longitudinal study of Crooks, Lubben, Petitti, Little, and Chiu (2008) examined the protective association of social network to dementia incidence among selected women. Participants (N=2,249) included ≥ 78 years community-dwelling women who received a hormonal replacement therapy. Specifically, participants included Whites (n=2009), Black (n=91), Hispanic (n=67), Asian/Pacific Islander (n=34), and other race (n=42). Older women with social support information were selected from the Kaiser Permanente Southern California-Health Maintenance Organization. Out of 2,249 older participants, there were 515 participants with depression while 1,734 without depression. Measures used in the study were the Lubben Social Network Scale (SNS), Telephone Interview for Cognitive Status – modified (TICS-m), and Telephone Dementia Questionnaire (TDQ). The Lubben Social Support Network is a 6-item patient-administered measure of the participants' active and perceived support, and confidant network. Three of the six items assess social network from family while the other three items assess social network from friends. The Lubben SNS is a five-point scale with higher scores suggesting larger social network. Participants' cognitive levels were assessed three times. First, the 23-item TICS-m was used to assess participants' cognition. It is strongly correlated to MMSE, with a score of > 27 indicates no/minimal cognitive impairment while a score of ≤ 27 indicates possible cognitive impairment.

Second, the TDQ, a 48-item proxy-administered measure, was used to assess the

cognitive status of participants with a TICS-m score of ≤ 27. The TDQ consists of items

encompassing various domains of the participants' cognition. There are three categories

of TDQ based on number of cognitive and functional impairment: dementia, no or

minimal impairment, and uncertain possible cognitive impairment (p.1222). The third

level of cognitive assessment included a review of medical records. Results showed a

protective role of bigger social network against dementia, that is, participants with higher

social network have lower risk of dementia in > 4 year study period. There were 268

participants developed dementia within the study period. Being older, with depression,

and with lower TICS-m score have greater dementia risk. Results also communicated that

having frequent contact (i.e., daily) with the participants have decreased dementia risk.

However, the study included only women and has an insufficient number of minority

participants limiting any subgroup comparisons.

      Another longitudinal cohort, observational study (James, Wilson, Barnes, &

Bennett, 2011) examined the association of social activity with cognitive decline. Social

activity is defined as having engaged in six types of activities within the past year (James,

Wilson, Barnes, & Bennett, 2011). The study measured social activity with a scale that

assesses how often an older adult engaged in six common types of activities involving

social interaction within a year. The six types of activities include: 1) have been to

restaurants, sporting events or teletract, or bingo game, 2) had either day or overnight

trips, 3) did volunteer or uncompensated work, 4) visited relatives and friends, 5)

participated in groups, such as in senior centers, Knights of Columbus, Rosary Society, 6)

attended church or religious activities (James, Wilson, Barnes, & Bennett, 2011). Older

adult participants rated each activity using a five-point scale: 1) once a year or less, 2) several times a year, 3) several times a month, 4) several times a week, 5) everyday or almost everyday (p. 3). A high score indicates a more socially active older adult. Participants included older adults without dementia (N=1,138), ≥ 65 years, from the Rush Memory and Aging Project in Chicago. Results supported the work of Barnes and colleagues (2004), which suggest more socially active older adults have lesser cognitive decline compared to older adults who are infrequently socially active (James et al., 2011). However, the study has mostly White participants (87.3%) that limit the generalizability of the results to the older adult population.

Further, a cross-sectional study (Rovner, Casten, & Leiby, 2016) examined the relationship between cognitive or social and physical activities, and education, depression, mobility, cognition, and functioning (i.e., IADL) among community-dwelling African American older adults (N=221), ≥ 65 years, with single- (n=45) or multiple- (n=176) domain amnestic MCI. The Alzheimer's Disease Cooperative Study Activities of Daily Living – Prevention Instrument (ADL-PI), a self-rating measure, was used to assess difficulty in performing IADLs. The Geriatric Depression Scale, a 15-item measure, was used to assess depression among older adults. The 25-item Florida Cognitive Activities Scale (FCAS) was used to measure the frequency of cognitive and social activities participation, such as board games, cooking, and going to church. While the 9-item U.S. Health Interview Survey (US-HIS) was used to assess physical activity participation through frequency and amount of time in minutes. Cognition, on the one hand, was assessed using the 12-item Hopkins Verbal Learning Test-Revised (HVLTR) and the National Alzheimer's Coordinating Center's Uniform Data Set (NACC-UDS)

Neurological battery. Results showed older African Americans' participation in cognitive

or social activities were positively related to several components of executive function

(i.e., attention, cognitive flexibility, perceptual-scanning skills, and processing speed).

Although the study sample were older African Americans, the study neither included

older adults with AD diagnosis nor residents of the congregate residential settings.

        Another study evaluated the association between social relationships and mild

cognitive impairment (MCI) among older adults (N=5,335), ≥ 55 years, in a large multi-

center prospective study of National Alzheimer's Coordinating Center (Brenowitz,

Kukull, Beresford, Monsell, & Williams, 2014). Social relationship is described as

having active relations with a partner or spouse, living with a relative or someone, and

having children (Brenowitz et al., 2014). It is measured using interview assessments on

marital status, living situation, and family members (Brenowitz, 2014). Marital status is

identified as married, widowed, divorced/separated, or never married. Living situation is

defined as living with a spouse or partner and relatives. Having children and siblings is

defined as having at least one biological child or sibling, living or deceased, or none.

Participants included Caucasians non-Hispanic (n=4,154), African Americans non-

Hispanic (n=746), Hispanic (any race, n=219), and other non-Hispanic (n=216). Results

communicated inconsistent relationships between social relationships and MCI. For

instance, the risk for acquiring MCI are lesser in widowed than married, but not for

divorced/separated or never married participants. Further, the study showed significantly

higher risk of developing MCI among participants living with others than living with a

spouse or partner, but not for those who are living alone. The study did not show any

relationship between MCI risk and having children or siblings. Although the study had

sufficient sample size and included four subgroups, it did not specifically determine which subgroup was more at risk.

Moreover, a negative social interaction can be a risk factor for cognitive decline at old age. The longitudinal cohort study of Wilson et al. (2015) supported Brenowitz and colleagues' (2014) findings. Wilson et al. (2015) examined the association of negative social interaction with the risk of MCI and cognitive decline among older people (N=529) from the Rush Memory and Aging Project in Chicago. The study assessed negative social interactions with other people using four domains: rejection, unwanted advice/intrusion, failure to provide help, and unsympathetic or insensitive behaviors. Older adults rated each of 12 items for these domains using a 5-point scale, 1 (never) to 5 (very often) (Wilson et al., 2015). The study reported that a higher level of negative social interaction is related to an increased rate of MCI and cognitive decline (Wilson et al., 2015). However, the study neither showed results from subgroup analysis nor included congregate residential setting (e.g., nursing home) residents.

Social support can also be measured using the scores of both emotional and instrumental support surveys. A study (Zahodne, Nowinski, Gershom, & Manly, 2014) that used normative data from the NIH Toolbox of older adults (N=482), $\geq$ 55 years, aimed to verify the conceptual separation of negative affect (e.g., anger, fear, sadness) and positive psychosocial factors (e.g., instrumental and emotional support, self-efficacy, life satisfaction). The study also aimed to describe the pattern of independent relationship between positive psychosocial factors and cognitive variables. Emotional support survey measures the perceptions that people in one's social network are available to listen to one's problems with empathy, caring, and understanding within the past month. While

instrumental support survey measures the perceptions that people in one's social network are available to provide material or functional aid in completing daily tasks, if needed within the past month (Zahodne et al., 2014). Results showed among positive psychosocial factors, emotional support and self-efficacy are more related to older adults' cognition. In particular, emotional support is positively related to executive functioning, which indicates older adults with higher emotional support have greater executive functioning (i.e., task switching), and processing speed. On the one hand, older adults with higher level of self-efficacy have better working memory compared to older adults with lower level of self-efficacy (Zahodne et al., 2014).

Socially active and engaged older adults have higher chances of making social interaction, especially in a neighborhood environment that offers various community resources. Social interaction is defined as an opportunity offered in the presence of physical (e.g., parks) and institutional resources (e.g., community centers) in a neighborhood environment. A prospective cohort, longitudinal population-based study (Clarke et al., 2015) among older adults (N=6,518), ≥ 65 years, from the Chicago Health and Aging Project (1993-2011), was conducted to examine the influence of neighborhood environment on cognition. Results showed that community resources available within the neighborhood (e.g., proximity to public transit, public spaced in good condition) are related to slower rates of cognitive decline. The study also found social interaction is associated with a lower incidence of dementia and slower rates of cognitive decline. Although the study included African Americans (71.6%) and Whites or other race (28.4%), it did not report any subgroup analysis and specified specific cognitive domain affected in the cognitive decline (Clarke et al., 2015).

Lastly, feelings of loneliness and isolation predict dementia risk among older

adults. A study (Holwerda et al., 2012) was conducted to examine the relationship

between social isolation, feelings of loneliness, and incident of dementia among

community-dwelling older adults for a period of 3 years. Participants (N=2,173) are non-

demented older adults, $\geq$ 65 years, who are part of the Amsterdam Study of the Elderly

(AMSTEL), which is a longitudinal population-based study. Social isolation is described

as "the quantity of social interactions" (p.1), and assessed through participants' living

arrangement (i.e., living alone), marital status (i.e., unmarried), and absence of social

support (i.e., without social support). Feelings of loneliness, on the one hand, refer to "a

lack of quality of social attachments and the evaluation of being alone as negative" (p.1).

The Geriatric Mental State Automated Geriatric Examination for Computer Assisted

Taxonomy (GMS AGECAT) was used to diagnose psychiatric disorders, while the

Cambridge Mental Disorders for Elderly Examination (CAMDEX) was used to diagnose

medical conditions, psychiatric disorders and cognitive function. Additional measures

include the MMSE, to assess cognitive function, and the Activities of Daily Living

(ADL) and the Instrumental Activities of Daily Living (IADL) scales to measure

function. Participants are diagnosed with clinical dementia if they have $\geq$ Level 3 GMS

AGECAT scores, while a diagnosis of cognitive impairment no dementia (CIND) is

considered for participants with organic levels 1-2 GMS AGECAT scores. Results

revealed that out of the total study population, only 433 participants developed feelings of

loneliness. The study also reported feelings of loneliness, not being alone, are related to

increased risk of incident dementia. Additional results showed, among older adults living

alone, 9.3% developed dementia while only 5.6% for those living with others. Among

older adults not or no longer married, 9.2% developed dementia while only 5.3% for

those who are married. Among older adults with no social support, 5.6% developed

dementia while 11.4% for those with social support. Older adults who received social

support have more chronic conditions (e.g., cerebrovascular disease, arthritis, diabetes,

dementia, depression) and greater limitations in functioning (i.e., ADL and IADL) than

those who did not receive social support, thus, needing more assistance. This also

indicates older adults who are living alone and not/no longer married have greater risk of

developing dementia than those living with others and married, while older adults with no

social support have lower risk of developing dementia. Older adults who have greater

feelings of loneliness have decreased MMSE scores (27.52 at baseline vs. 25.84 at

follow-up), which suggest an increased risk of incident dementia, compared to having no

feelings of loneliness (28.05 at baseline vs. 27.06 at follow-up).

     Out of the nine studies that showed the relationship between social support and

cognitive decline, only two (Rovner et al., 2016; Zahodne et al., 2014) were cross-

sectional studies while the rest were longitudinal studies. Also, five of the nine studies

specifically mentioned older African American subgroup. However, no studies

exclusively included participants from the congregate residential settings.

     Conceptualization of depression. Depression in older adults (or late-life

depression) with AD is common with a prevalence rate of 12.7% using DSM criteria

while 42% with dementia specific criteria (Chi et al., 2015; Strober & Arnett, 2009). The

latter is within the range of the estimated prevalence rate of depression in the clinical

setting, which is 30-50% (Lee & Lyketsos, 2003). While the population of the general

older adults with dementia who have depression and anxiety is approximately 60-70%

(Walker, 2004). Among the long-term care service providers, nursing homes have the

highest rate of depression diagnosis at 48.7% (Harris-Kojetin et al., 2016) while hospice

(22.9%) and residential care communities (23.2%) have the lowest rates. Depression can

be a comorbidity in AD that causes greater impairment not only in the activities of daily

living (ADLs) (Lee & Lyketsos, 2003), but also in the instrumental activities of daily

living (IADLS) that contribute to early nursing home placement (Lee & Lyketsos, 2003).

Neurodegenerative process in AD is also viewed as a contributory factor to the

development of depression (Lee & Lyketsos, 2003). In most AD cases, it is challenging

to diagnose the extent of depression because it either masks the symptoms of Alzheimer's

(Strober & Arnett, 2009) or seen as an 'understandable phenomenon' at old age (Law,

Laidlaw, & Peck, 2010). For this particular population, determining the onset (i.e., early-

or late-onset) of depression plays a major role in determining the course of treatment.

Previous research works have shown that late-life depression is associated with

brain changes (Strober & Arnett, 2009) that have accumulated through a lifetime, such as

the influence of cardiovascular diseases. Kumar, Bilker, Jin, and Udupa (2000) reported

that older adults with depression have smaller frontal volumes and more brain lesions.

While Taylor et al. (2005) associated late-life depression with subcortical gray and white

matter lesions.

In early studies of depression, the Research Diagnostic Criteria was used to define

and classify types of depression. A diagnosis of depression was made if an older adult has

five of the following eight symptoms: weight loss, sleep disturbance, loss of energy,

psychomotor retardation, loss of pleasure in activities, guilt feelings, complaints of

inability to concentrate, and recurring suicidal thoughts (Yesavage et al., 1983, p. 42).

Currently, the DSM criteria (IV) is used to classify depression in the general

population using three categories: major and minor depression, and dysthemia. The

prevalence rate for major, and minor depression, and dysthemia in older adults with AD

are 5-23%, 20-30%, and 8-34% respectively (Lyketsos & Olin, 2002; Regan, Katona,

Walker, & Livingston, 2005; Strober & Arnett, 2009). In the revised DSM-V criteria,

depression is categorized into major depressive episode, persistent depressive disorder,

disruptive mood dysregulation disorder, and premenstrual dysphoric disorder (Grohol,

2013). Depression in older adult population affects their executive functioning, nonverbal

and verbal memory, psychomotor processing, and learning (Beats, Sahakian, &

Levy,1996; Elderkin-Thompson et al., 2003). Hence, it is important to assess the extent

and severity of depression symptoms.

In addition to the DSM classification, depression in AD can be classified using

the National Institute of Mental Health provisional diagnostic criteria for depression on

AD (NIMH-dAD) (Lee & Lyketsos, 2003; Olin et al., 2002; Teng et al., 2008). An older

adult must have at least three of the following criteria in 2-weeks to be diagnosed with

dAD: depressed mood, decreased pleasure, social isolation, appetite and sleep disruption,

changes in psychomotor, irritability, loss of energy, hopelessness, and suicidal ideation

(Olin et al., 2002; Teng et al., 2008, p. 14). To meet the diagnosis, one of the symptoms

must be either depressed mood or decreased pleasure (Teng et al., 2008).

The use of appropriate assessment tools, with trained examiners, is tantamount to

having an accurate diagnosis, which should be given emphasis in dealing with depressed

older adults. It is vital that assessment tools were validated (Strober & Arnett, 2009) to a

specific population of older adults (i.e., 65 years and over) with the particular health

condition (AD dementia) to obtain reliable results, prevent misdiagnosis, and identify

appropriate treatment.

Measures of Depression. The Geriatric Depression Scale, Beck Depression

Inventory, and the Hamilton Depression Rating Scale will be discussed in the succeeding

paragraphs.

Geriatric Depression Scale (GDS). Older adults experiencing depression usually

have problems in memory and impairment in cognition (Yesavage et al., 1983; Kahn,

Zarit, Hilbert, & Niederehe, 1975). They also experienced somatic symptoms and are

resistant to psychiatric evaluation than younger adults (Yesavage et al., 1983; Wells,

1979).

The self-rated Geriatric Depression Scale is designed to be administered to the

older population. It focuses on the psychological, both subjective affective and

behavioral, aspects of depression (Parmelee, Lawton, & Katz, 1989, p. 332). It was

developed in response to the need of having a measure of depression specifically for

older adults, who have unique manifestations than younger adults (Yesavage et al., 1983).

Researchers mindfully chose 100 questions encompassing various topics, such as somatic

and cognitive issues, motivation, orientation of future/past, self-image, losses, agitation,

traits, and mood (p. 40) to be administered to 47 participants. The 30 items highly

correlated with the total score consist the Geriatric Depression Scale-original version,

with an inter-item correlation between 0.47 to 0.83.

When the Geriatric Depression Scale was administered to older adults in senior

centers and housing projects (n=40), and those undergoing depression treatment (n=60),

it yields a mean inter-item correlation of 0.36, a high internal consistency Cronbach's

alpha coefficient of 0.94, and a test-retest reliability coefficient of 0.85. Further, the

Geriatric Depression Scale shows high sensitivity and specificity rates. Using a cutoff

score of 11, the scale has 84% ability to correctly identify number of depressed older

persons (sensitivity rate), and a 95% of correctly identifying number of non-depressed

older persons (specificity rate). However, a higher cutoff score of 14 resulted in a

sensitivity rate of 80% while a specificity rate of 100% (Yesavage et al., 1983).

The Geriatric Depression Scale has high internal consistency and reliability. One

of its items is stated, "Are you in good spirits most of the time?" The measure shows

convergent validity with other measures of depression, such as the Zung Self-Rating

Scale for Depression, Hamilton Rating Scale for Depression, and Beck Depression

Inventory. The Geriatric Depression Scale is useful in assessing older adults' depression

in the psychiatric, community, and nursing home settings (Lesher, 1986). In a study

Lesher (1986) conducted among 51 nursing home residents, the scale shows 100%

sensitivity among the residents experiencing major depression, thus, making it valid to be

administered among older nursing home residents.

Parmelee and colleagues (1989) conducted a follow-up study using the Geriatric

Depression Scale to a more diverse population (N=806), in terms of cognitive and

functional levels. Participants were nursing home (n=310) and apartment complex

residents (n= 486), aged 61 to 99 years. Results for 1-year reliabilities using the 15-item

Geriatric Depression Scale-short form (Yesavage & Sheikh, 1986) revealed a coefficient

correlation of 0.86 for both cognitively intact and impaired groups (Parmelee et al.,

1989). Cognitively impaired participants, with depression at any levels, has a sensitivity

rate of 68% and 69% for cognitively intact participants, while the specificity rates for the

two groups were 84% and 87%. Conversely, the sensitivity rate for participants with

major depression who are cognitively impaired was 60% and 47% for cognitively intact,

while both have high specificity rates of 91% and 92%.

Results of the follow-up study (Parmelee et al., 1989) reinforced the validity and

reliability of the Geriatric Depression Scale measure among nursing home residents. It

also suggests that the scale is not affected with the length of stay in the nursing homes

and apartment complex, and showed significant correlation with older adults' health,

including cognitive and functional impairment. The Geriatric Depression Scale is also

easier to administer (Parmelee et al., 1989), internally consistent, and valid among

participants who are physically ill and cognitively impaired or demented (Montorio &

Izal, 1996; Yesavage et al., 1983).

Beck Depression Inventory (BDI). The BDI was developed to assess the intensity

or severity of depression (Beck & Steer, 1984, p. 1365). It has two earliest versions, the

1961- and 1978-versions that were revised later. Beck and Steer (1984) performed a

study to evaluate and compare the internal consistencies of the two BDI versions. The

1961-version was administered to 606 inpatient and outpatient admissions from two

hospitals in Philadelphia. The 1978-version, on the one hand, was self-administered to

248 consecutive admissions in Philadelphia's Center for Cognitive Therapy. Both

versions have high internal consistency. The Cronbach's alpha coefficient for the 1961-

version was 0.88, while 0.86 for the 1978-version.

The two versions of BDI consist of 21 items comprising clinical symptoms, with

response options ranging from 0 to 3, increasing in intensity. Some of the topics included

in the BDI comprise of mood, sense of failure, guilt feelings, self-dislike, and social

withdrawal (p. 1366). These are clinically derived symptoms of depression, which were

reviewed using psychiatric literature (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961).

One of the item statements under guilt feelings is stated, "I don't feel particularly guilty"

(Beck, 1996). Trained personnel administered the 1961-version using only the present

day's feelings of the participant, while the 1978-version was self-administered and used

the participants' feelings in the past week (Beck & Steer, 1984). The recently revised

version, BDI-II, was created to align with the latest DSM (IV) criteria for depression and

used participants' feelings in the past two weeks.

The BDI displays good internal consistency (Beck & Steer, 1984) and convergent

validity with the Geriatric Depression Scale (Montorio & Izal, 1996). However, it does

not specifically emphasize on older adults' assessment of depression.

Hamilton Depression Rating Scale (HAMD). This measure was designed to be

administered to participants who are already diagnosed with depression. It is also useful

in evaluating treatment outcome, such as the first generation of antidepressants (Bagby,

Ryder, Schuller, & Marshall, 2004; Hamilton, 1960). The HAMD is a 21-item measure

that contains 17 specific symptoms of depression, such as depressed mood, guilt, work

and interests, loss of insight, and loss of weight. Additionally, the four symptoms with

sub-items are insomnia, anxiety, somatic symptoms, and losses (Hamilton, 1960). It has a

five- and three-point response options. The five-point scale is rated as 0 = absent, 1 =

mild or trivial, 2 and 3 = moderate, and 4 = severe, while the three-point scale is rated as

0 = absent, 1 = slight or doubtful, and 2 = clearly present.

A review of studies (Bagby, Ryder, Schuller, & Marshall, 2004) revealed that

HAMD have poor content validity, and with items that have poor interrater and retest

reliability. The review reported an internal reliability Cronbach's alpha coefficient

between 0.46 to 0.97, an interrater reliability correlation between 0.82 to 0.98, and a

retest reliability coefficient of 0.81 to 0.98 (Bagby et al.). More specifically, Reynolds

and Kobak (1995) obtained an internal reliability Cronbach's alpha coefficient of 0.92

and a retest reliability correlation of 0.96 among psychiatric outpatients. While Gastpar

and Gilsdorf (1990) obtained an internal reliability of 0.48 among multilingual depressed

patients.

Overall, HAMD displays convergent validity with the Geriatric Depression Scale

(Lesher, 1986). However, it is unable to assess atypical symptoms of depression, such as

hypersomnia and hyperphagia. The measure also does not identify either the intensity or

frequency of the symptoms (Hamilton, 1960).

Relevant research findings. The succeeding sections discuss relevant findings on

the association of extent of social support and extent of depression, and extent of

depression and level of cognition.

Social support and depression in AD. Three studies demonstrate the relationship

between social support and the incidence of depression among older adults. Two of these

studies (Chi & Chou, 2001; Rovner, Casten, & Leiby, 2016) examined the influence of

social network, support, and activities on depression level and incidence. While one of

three studies (Shouse, Rowe, & Mast, 2013) communicated the consequence of

depression in the size of social network.

Chi and Chou (2001) determined the relationship between social support and

depression, specifically the influence of social network and quality of social support on

depression, among ≥ 60 years older adults. Participants (N=1,106) of the cross-sectional

study were randomly selected from Hong Kong's Census and Statistics Department list of

community-dwelling Chinese elderly. The Center for Epidemiological Studies of

Depression (CES-D), a 4-point 20-item scale, was used to measure depressive symptoms

experienced by older adults in a week with 60 as the highest possible score. Another scale

was used to measure ADL, IADL, and physical performance, with bigger scores suggest

greater disability. Further, marital status as well as number of relatives and friends, were

used to measure social network while the frequency of social contact with relatives and

friends were self-reported. Quality of social support was assessed through participants'

level of satisfaction from their social network. Results of the study showed a positive

relationship between impairment on IADL and physical performance, and depression,

which indicates participants with greater impairment have higher levels of depression. In

terms of network size, participants with more closed relatives and friends have lower

levels of depression. For network composition, participants who have seen family

members only in a month have lower levels of depression compared to those who have

seen friends only. On the one hand, frequency of contact, satisfaction of social support,

instrumental/emotional support, and helping others were negatively related to levels of

depression. Participants who frequently contact with relatives and friends have lower

levels of depression compared to those who have infrequent contacts with relatives and

friends. Participants with higher levels of satisfaction of social support from their social

network have lower levels of depression compared to those who have lower levels of

satisfaction. Participants who received more reliable help when ill and more tangible help

from relatives have lower levels of depression. Also, those who frequently provided

comfort and financial help to others have lower levels of depression. However, the study

was exclusively conducted to Chinese older adults whom the influence of culture on

social support should be considered. As it was a cross-sectional study, causal relations

among the variables could not be determined.

In addition, Rovner, Casten, & Leiby (2016) conducted another cross-sectional

study and examined the relationship of cognitive or social and physical activities, with

education, depression, mobility, cognition, and functioning (i.e., IADL) among

community-dwelling older African Americans, ≥ 65 years, with amnestic MCI (N=221),

single- (n=45) or multiple (n=176) domain. Measures used include the ADL-PI, Geriatric

Depression Scale (GDS), Florida Cognitive Activities Scale (FCAS), the U.S. Health

Interview Survey (US-HIS), Hopkins Verbal Learning Test-Revised (HVLTR), and the

National Alzheimer's Coordinating Center's Uniform Data Set (NACC-UDS)

Neuropsychological Battery. The ADL-PI is a self-rating measure to assess difficulty in

performing the IADLs, with a high score of 45 suggesting better function. The GDS is a

15-item measure of depression, validated in the older adult population. The FCAS is a

25-item 5-point rating scale to assess the frequency of cognitive and social activity

participation (e.g., board games, cooking, going to church), with the highest score of 125

indicating "more frequent activity participation" (Rovner et al., 2016, p. 9). The US-HIS

is a 9-item measure to assess the frequency and amount of time in minutes in physical

activity participation (e.g., walking, dancing, biking) for the past two weeks. Both the

HVLTR and the NACC UDS Neuropsychological Battery were used to assess cognition.

The HVLTR is a 12-item word-list to test learning and memory while the NACC UDS

Neuropsychological Battery comprises of several tests for specific cognitive function

(i.e., verbal episodic memory, attention, semantic memory, processing speed, and

executive function). Results showed cognitive or social activities were positively related to IADL function and depression, while physical activities were independently related to depression. The study also reported that depressive symptoms were usually experienced among older adults with less participation in both cognitive or social and physical activities.

In contrast to previous studies, Shouse, Rowe, & Mast (2013) examined the influence of depression and cognitive function on social network size as well as the type of relationship. Participants (N=79) in this cross-sectional study consisted of community-dwelling older adults, ≥ 60 years, who were part of the Study of Thinking and Relationship (STAR). There were 91.3% Caucasian, 6.3% Black, 1.3% Asian, and 1.3% Hispanic participants. Measures used in the study included the Dementia Rating Scale – Version Two (DRS-2), the Hopkins Verbal Learning Test – Revised (HVLT-R), the Social Convoy Measure, and the Geriatric Depression Scale (GDS). The DRS-2 was used to measure cognitive function and detect dementia with higher scores suggesting higher cognitive function. The HVLT-R measured the neuropsychological areas of verbal learning and memory ability. While the Social Convoy Measure assessed the social network size, using three concentric circle diagram. The number of people written in the diagram indicates the participants' network size. The GDS, on the one hand, is a 15-item measure of depression among older adults with higher scores suggesting greater depression. Results of the study showed participants with lower HVLT-R score have smaller social network size, while those with lower DRS-2 score have smaller outer circle network. Also, depression scores were negatively associated with social network size (i.e., inner and middle). Overall, the study reported the GDS and HVLTR strongly predict

participants' social network size. However, the study has small sample size with mostly Caucasian and female participants, and causality and directionality of relationship among the variables cannot be assumed.

In sum, social support influences the extent of depression among older adults. For instance, older adults with strong social support experience less depression compared to those with limited support. On the one hand, depression can determine an older adult's network size through limiting its surrounding social network. The three studies on social support and depression have cross-sectional designs with community-dwelling participants. Only one (Rovner et al., 2016) of three studies was exclusively conducted to older African Americans with MCI, but not in the congregate residential settings (e.g., nursing home). There is a lack of literature in the relationship between social support and depression among older adults; thus, deserves further investigation.

Depression and cognition in AD. There is a substantial amount of studies on depression and dementia with varied results. Six of the eight studies on depression and cognition showed that older adults who experienced depression have lower cognitive level (Al Hazzouri et al., 2013, Dotson, eydoun, & Zonderman, 2010; McCutcheon et al., 2016; Rapp et al., 2011; Steenland et al., 2012; Zahodne, Nowinski, Gershon, & Manly, 2014). While the remaining two studies (Snowden et al., 2015; Benoit et al., 2012) focused on the prevalence of depression across the different cognitive continuum.

Dotson, Beydoun, & Zonderman (2010) examined the relationship between the number of episodes of elevated depressive symptoms and the risk of mild cognitive impairment (MCI) and dementia among community-dwelling older adults (N=1,239) enrolled in the Baltimore Longitudinal Study of Aging (BLSA), a prospective study.

Participants included older adults, ≥ 50 years, who are non-Hispanic white (n=1,116),

non-Hispanic black (n=104), and from other races (n=19). Results showed that every

episode of elevated depressive symptoms before dementia onset was related to a 14%

increase in risk for all-cause dementia. They also reported that one elevated depressive

symptom occurrence during follow-up has a dementia risk between 87% - 92%, while

two or more elevated depressive symptoms occurrence during follow-up almost doubled

the dementia risk. However, there is no significant relationship between recurrence of

elevated depressive symptom over time and incidence of MCI and AD.

Rapp and colleagues (2011) conducted another longitudinal study comparing

cognitive decline, using both MMSE and CDR scores, between demented nursing home

residents (N=313), > 54 years, with comorbid depression and without a history of

depression who are enrolled in a prospective, longitudinal study in cognitive aging.

Participants included 84.3% White (n=264), 10.9% African Americans (n=34), 3.8%

Hispanic (n=12), and <1% from other ethnicities (n=3). Results showed a rapid cognitive

decline in residents with dementia while a further increase in cognitive decline among

nursing home residents with both dementia and depression. The results also

communicated that it is the interaction between dementia diagnosis and history of

depression, but not history of depression alone, significantly increased the model fit.

Also, among groups of nursing home residents, older adults with AD dementia showed a

much faster cognitive decline. This study supports earlier findings on the association of

depression in AD with greater impairment in quality of life and earlier nursing home

placement (Lyketsos & Olin, 2002); however, most of the participants are White

residents.

In addition, Steenland et al. (2012) conducted a study to older adults (N=8,855) who are cognitively intact (n=5,845) and diagnosed with MCI (n=3,010) at baseline from the National Alzheimer's Coordinating Center (NACC) Uniform Data Set (UDS) to determine if late-life depression predicted the transition between normal cognition and MCI, and MCI to AD. Older adults (mean age=74) have at least two visits between September 2005 and January 2011. After excluding cognitively intact participants who progressed to MCI and participants with MCI who reverted to normal cognition, analyses only included 5,607 cognitively intact and 2,500 with MCI older adults. Results revealed that recent depression, not past, increased the risk of progression from normal to MCI. Older adults with MCI have twice likelihood (35%) of having a history of recent depression than cognitively intact (18%) older adults. Depressed older adults (9-17%), based on clinician judgment, had a significantly worse cognitive test performance. While older adults who were always depressed at each follow-up visit had greater risk of progression from normal to MCI, but a moderate progression is observed from MCI to AD than "never depressed" older adults without a history of depression. The study also indicates an older adult's improvement in depression can lower the risk of disease progression. The study consisted mostly of White participants (83%). Thus, it did not present any subgroup analysis. It also included medication intake (e.g., SSRI and other anti-depressants), which were excluded in previously mentioned studies.

Al Hazzouri et al. (2013) examined the relationship of long-term cumulative depression with cognitive decline and dementia in older women (N=7,240) enrolled in a prospective cohort study on osteoporotic fractures between 1988 and 2008. Participants included White and African American older women (mean age=73.3 years). Results

showed a strong and independent association between long-term depression and risk of

developing dementia or MCI. Participants with greater depressive symptom burden have

poorer cognitive outcomes (i.e., verbal memory recall, and category and verbal fluency),

and increased cognitive decline and risk of dementia. However, the study only used

Geriatric Depression Scale (GDS) to measure depression, while various measures (i.e.,

Mini-Mental State Examination, Trails B, California Verbal Learning Test, Digit Span,

Modified MMSE, category and verbal fluency tests) were used to measure cognitive

function. Although the study reported interesting results, it only consisted of older

women.

Meanwhile, Zahodne, Nowinski, Gershon, and Manly (2014) examined the

relationship between depressive symptoms and cognitive performance among

community-dwelling African American (n=37) and non-Hispanic White (n=292) older

adults. The study also determined the difference of perceived stress and self-efficacy

between the two groups. Participants (N=329), > 54 years, included in the study were part

of the NIH Toolbox normative study for the Assessment of Neurological and Behavioral

Function. The NIH Toolbox, which consists of standardized web-based measures, was

used to assess participants' depressive symptoms as well as cognitive abilities. Four

modules comprised the NIH Toolbox (i.e., motor, sensation, emotion, and cognition), but

the study only focused on emotion and cognition modules. Results revealed greater

depressive symptoms were significantly related to slow processing speed among non-

Hispanic White participants while poorer executive function (e.g., task-switching

inhibition) and episodic memory for older African Americans. Between the two groups,

African Americans have fewer depressive symptoms and lower processing speed score

than non-Hispanic White counterparts. Unlike prior studies on depression, this study is

cross-sectional and has a small sample size of older African Americans.

In another study on depression, McCutcheon et al. (2016) assessed the

relationship of AD neuropathology and depression in MCI and mild dementia (dAD)

using data of participants (N=290) who died with MCI or mild dementia diagnoses who

had autopsy from NACC. The study indicates depression in early AD is not related to

neuropathology and neurofibrillary tangle pathology. Prior death, participants should be

diagnosed with one of the following to be eligible for the study: cognitively intact healthy

controls (HC, n=120), amnestic and non-amnestic MCI (n=77), and probable or possible

dAD (n=93). Study participants are mostly White while the remaining are from other race

(HC=120 vs. 0, MCI=72 vs. 5, dAD=90 vs. 3), with the following mean age at death,

87.6 years, 89.6 years, and 84.7 years, respectively. Results of the study also reported that

history of depression (i.e., last 2 years), greater severity of neuropsychiatric symptoms

and lesser education were related to greater depression (McCutcheon et al., 2016).

The last two studies on depression and cognition focused on the prevalence and

incidence of depression across the cognitive spectrum. Snowden et al. (2015) examined

the prevalence, incidence, and severity of depression among older adults (N=27,776) who

are cognitively intact (n=10,194), and diagnosed with dementia (n=10,486) and MCI

(n=7,096) from the NACC UDS data between 2005 and 2013. Similar to other studies

that used NACC UDS, data were collected at the AD Research Centers using their own

protocol. Participants (mean age=73.3 years) included White (cognitively intact=8,292;

dementia=8,622; MCI=5,526), Black (cognitively intact=1,511; dementia=1,237;

MCI=1,110), Hispanic (cognitively intact=613, dementia=919, MCI=625), and other

races (cognitively intact=386, dementia=619, MCI=449). Results reported a strong

relationship between depression and cognitive impairment over time, which suggests

older adults with MCI and dementia have 2.5 times higher rates of depression than

cognitively intact older adults. Demented older adults also have increased likelihood of

needing some assistance than cognitively intact older adults and with MCI who are

independent.

Findings from the work of Snowden et al. (2015) supported earlier work of Benoit

and colleagues (2012) who conducted a cross-sectional study to examine the prevalence

of apathy and depression among older participants (N=734) with probable mild AD.

Participants in the study are ≥ 65 years, with an MMSE score > 19, and diagnosed with

probable AD based on the NINCDS-ADRDA criteria. The diagnostic criteria for

depression in AD were used to diagnose participants' depression, while the diagnostic

criteria for apathy in AD and neuropsychology disorders were used to diagnose apathy.

Results showed that the prevalence for depression was 47.9% while 41.6% for apathy.

The three most frequent depressive symptoms include fatigue or loss of energy (59.4%),

decreased pleasure to activities (46.2%), and psychomotor retardation (36.9%) (p.328).

The study also reported participants with depression, whether or not associated with

apathy, affects 47.8% of the study participants. Further, the "apathy and depression"

subgroup showed significantly lower MMSE and IADL scores compared to "no apathy

no depression," "apathy," and "depression" subgroups.

Out of eight studies on depression and cognitive decline, only two have cross-

sectional design while the other six have longitudinal designs. Further, there is only one

study (Rapp et al., 2011) specifically focused on nursing home residents while the

remaining seven studies have community-dwelling participants as well as from multi-center longitudinal studies. Five studies included participants diagnosed with MCI, AD, and dementia. Lastly, six of the eight studies specified racial subgroups, but with mostly White participants. This study differs from previous research works because it will focus on OAAs who have AD diagnosis living in the congregate residential settings.

        Conceptualization of functional activity. Functional activity is the older adults' ability to perform instrumental activities of daily living (IADLS) independently (Johnson, Lui, & Yaffe, 2007). Functional activity quite evolved as a concept, from the simple performance of ADLs to a more complex execution of IADLs that are associated with a person's social function. Functional activity encompasses a number of activities, recognizing a hierarchy of the complexity level for each task (Pfeffer, Kurosaki, Harrah, Chance, & Filos, 1982; Lawton & Brody, 1969). It may also refer to the performance of self-care and physical activity (Fisher, 2008). Further, recent research works reveal the usefulness of functional activity (i.e., IADLs) as a differentiating factor among chronically debilitating diseases, such as MCI, AD, and other types of dementia. Studies also showed that functional activity influenced cognition, such as judgment and problem-solving (Mayo et al., 2012) as well as progression of cognitive decline (Nourhashemi et al., 2009).

        In a study Marshall et al. (2015) conducted, AD affects older adults' ADL and IADL functioning. Between the two, the IADL is extremely useful in discriminating MCI from AD (Brown, Devanand, Liu, & Caccappolo, 2011). In another study, IADL has shown sensitivity in discriminating MCI from clinically normal cognition, especially on two items: "remembering appointments," and "assembling tax records" (Marshall et al.,

2015). While three IADL items in FAQ measure were more sensitive to the progression

of clinically normal cognition to MCI: "paying attention to TV programs," "paying bills,"

and "heating water" (Marshall et al., 2015).

       The functional status of older adults should be given equal importance with

cognitive status since it affects their performance on ADL, IADL, health outcome, and

overall life expectancy, such as older adults ages 75 years and over with ADL limitation

experience 5-year shorter in life expectancy than those without ADL limitation (Keeler,

Guralnik, Tian, Wallace, & Reuben, 2010). As the functional activity evolves along with

its different uses, different measures were also designed, such as the Functional Activities

Questionnaire and the Instrumental Activities of Daily Living Scale, to quantify the

impact of impaired function to overall health outcome.

       Measures of Functional Activity. The Functional Activities Questionnaire and

Instrumental Activities of Living Scale will be described below.

       Functional Activities Questionnaire (FAQ). The FAQ measure was developed to

assess older adults' social function (Pfeffer, Kurosaki, Harrah, Chance, & Filos, 1982).

The FAQ acknowledges the concept of skills' hierarchy (i.e., simple to complex) in the

performance of daily activities as proposed by the IADL Scale (Lawton & Brody, 1969;

Pfeffer et al.). It is a brief 10-item measure that comprises different IADLs, such as

writing checks, paying bills, and balancing a checkbook to traveling out of neighborhood,

driving, and arranging to take buses (Pfeffer et al., p. 327). The FAQ is a four-point,

informant-rated, scale that ranges from 0 to 3 (i.e., 0 = normal, 1 = does by self, 2 = needs

assistance, 3 = dependent) (Mayo, 2012; Pfeffer et al.). In instances where older

participants have not yet performed the activities, they can either rate it as 0 = never did,

but could do now, or 1 = never did and would have difficulty now (Pfeffer et al., p. 326).

When Pfeffer and colleagues (1982) administered the FAQ to 178 diverse participants

(i.e., normal, depressed, and with senile dementia), the FAQ obtained an internal

reliability of ≥ 0.80. It has a sensitivity rate of 85% while a specificity rate of 81%. The

measure also displays convergent validity, a correlation of 0.72, and concurrent validity

with the IADL Scale (Pfeffer et al.).

In sum, the FAQ describes older adults' functional activity as an ability to

perform IADL in reflection to their social function. It has the ability to identify normal

vs. demented older participants, or MCI vs. very mild AD (Pfeffer et al.; Teng et al.,

2010). The measure has high reliability and valid to be administered to a diverse older

population, including participants with mild to moderate dementia.

Instrumental Activities of Daily Living (IADL) Scale. In addition, Lawton's

IADL Scale, which can be administered within 10-15 minutes, was developed to measure

eight domains of IADL to older adults in the community, hospital, clinic, and short-term

skilled nursing facilities. The scale is not appropriate for use among older adults in the

long-term care setting, such as the nursing homes, since residents are expected to be in

need of assistance (Graf, 2008, 2013; Lawton & Brody, 1969) and with increased

dependency (Fisher, 2008). The eight domains of IADL, necessary independent living

skills (Fisher, 2008), are the following: ability to use telephone, shopping, laundry,

managing finances and medication, food preparation, transportation, and housekeeping

(Lawton & Brody, 1969). The scale is scored from 0 to 8, with the lower score indicative

of greater dependency while the higher score suggests greater independence.

The Lawton IADL, a self-report scale, has an established validity to measure the eight domains of IADL. It has an inter-rater reliability of 0.85. However, the reliability of the instrument was only administered to a small sample size (n=12) (Graf, 2013). The measure has a sensitivity rate of 57% while a specificity rate of 92% (Pfeffer et al.). The validity (e.g., convergent) of the Lawton IADL scale was tested using correlation with the physical classification, mental status questionnaire, and the behavior and adjustment rating scale at 0.01 and 0.05 level of significance (Lawton & Brody, 1969). The IADL measure has an established concurrent and convergent validity with the Physical Self-Maintenance Scale (Fisher, 2008; Graf, 2006). Although the IADL Scale was regarded as the best measure to capture the activities of retired older people prior to the development of FAQ, it did not include more complex activities (Pfeffer et al.). This limitation of the IADL Scale was then addressed in the FAQ.

Relevant research findings. The succeeding sections present the associations between extent of depression and level of functional activity, and level of functional activity and level of cognition.

Depression and functional activity in AD. Previous works on depression showed its relationship with functional activity. Starkstein, Jorge, Mizrahi, and Robinson (2005) examined the frequency of major and minor depression in AD, and determined the functional and psychopathological impact of depression as well as changes in prevalence at each stage of AD. Participants (N=670) included older adults (mean age=72 years) from dementia clinic diagnosed with probable AD based on the NINCDS-ADRDA criteria. There were 177 older adults with major depression, another 177 with minor depression, and 316 with no depression. The study reported both major and minor

depression have significant relationship with greater functional impairment in ADLs, and more severe social dysfunction (i.e., on quality and quantity of social support) and psychopathology (e.g., anxiety, apathy, irritability) compared to non-depressed participants. The result also suggests a positive relationship between extent of depression and functional impairment in AD, which indicates a greater functional impairment is reported as depression increases.

Palmer et al. (2011) determined the predictive role of neuropsychiatric symptoms in AD progression among newly-diagnosed Italian older adults (N=177) who visited memory clinic outpatient services. Participants (mean age=73.1 years) have AD diagnosis based on DSM IV and NINCDS-ADRDA criteria, with two or more clinic visits and an MMSE score > 9. Disease progression was evaluated through cognitive and functional decline. The MMSE was used to measure cognitive decline while Katz' basic ADL scale was used to assess functional decline. The Neuropsychiatric Inventory was used to assess the neuropsychiatric symptoms through an informant. The neuropsychiatric symptoms consist of five categories: apathy, affective, psychomotor, manic, and psychotic syndromes. Results showed 74.6% (n=132) of the participants have one or more neuropsychiatric symptoms at baseline, and 37.3% (n=66) have an affective syndrome that includes anxiety and depression. The study also reported specific neuropsychiatric symptoms were related to both functional and cognitive decline in AD progression. For instance, older adults with the affective syndrome (i.e., anxiety and depression) had greater (i.e., twofold) risk of functional decline than without affective syndrome. While the risk of cognitive decline was threefold for participants with manic syndrome (i.e., euphoria and disinhibition) compared to without manic syndrome at baseline.

Further, Brown and colleagues (2013) evaluated the effect of depression and

cognition to function among older adults (N=3,117) diagnosed with amnestic (n=2,488)

and nonamnestic (n=629) MCI, who are part of the NACC UDS data (i.e., between 2005

and 2009). Cognition was assessed through older adults' performance processing speed.

Participants (mean age=74.37) included Caucasians (n=2,477) with amnestic (n=2,017)

and non-amnestic MCI (n=460), and African Americans (n=490) with amnestic (n=360)

and non-amnestic (n=130) MCI. Among the study participants, Caucasians have greater

proportion of older adults with amnestic MCI. Older adults with amnestic MCI have

more functional impairment and lesser independence while older adults with non-

amnestic MCI have better Logical Memory Delayed test score (i.e., memory), but poorer

Trail Making Test B score (i.e., executive function). Results revealed that a significant

relationship with depression, memory impairment, and processing speed were

significantly related to functional impairment. Processing speed was reported to be a

mediator among observed variables. It partially mediated the relationship between

depression and function while fully mediated the relationship between executive function

and function among older adults with MCI and amnestic MCI. The study also revealed

depressed residents were younger, less educated, had more vascular impairment, and

experienced more functional impairment compared to the non-depressed and mildly

depressed residents.

The three studies reviewed to show the relationship between depression and

function used longitudinal designs. Two of the three studies included participants from

the outpatient memory and dementia clinics while one from a multi-center study. Only

one study (Brown et al., 2013) included older African American subgroup with MCI and

depression while the other two studies have older patients diagnosed with AD and

depression.

   Functional activity and cognition in AD. Six studies demonstrate the relationship

between functional activity and cognition among older adults. Marshall et al. (2011)

examined the relationship between executive function and IADL among older adults, 55

to 91 years, who were assigned to one of the three diagnostic groups based on baseline

data: cognitively normal controls (n=228), MCI (n=387), and mild AD (n=178).

Executive function was measured using the difference of Trail Making Test (TMT) B and

A (TMT B - A), higher scores indicating greater impairment, and the Wechsler Adult

Intelligence Scale-Revised Digit Symbol, lower scores suggesting greater executive

function impairment. While the global cognitive function was measured using the

MMSE, lower scores indicating more cognitive impairment, and IADL was assessed with

the FAQ, higher scores suggesting more functional impairment. Their work demonstrated

a strong negative relationship between the MMSE global cognitive scores and the FAQ

scores among older adults with AD. This indicates that older adults with lower MMSE

scores (i.e., more cognitively impaired) have higher FAQ scores (i.e., greater IADL

impairment). The significant influence of older adults' executive dysfunction on IADL

was observed across three diagnostic groups.

   An older adults' functional status influenced their cognition and ability to make

judgment. Mayo et al. (2012) determined the association between functional status and

judgment or problem-solving of older adults (N=3,855) with dementia using the NACC

UDS data, between Sept. 2005 and Sept. 2007. Participants included in the study (mean

age=75.7 years) consist of non-Hispanic White (n=2,997), non-Hispanic Black (n=471),

Hispanic (n=280), and other race (n=80). There were 67.6% (n=2,607) with probable AD while 8.7% (n=337) with possible AD. Most of the study participants (84.2%) reside in a single- family residence. Functional status was measured using the FAQ, while cognition (i.e., mental status and executive function) was assessed using the MMSE and TMT-B. Results communicated IADL was an indicator of older adults' judgment or problem-solving ability. There was a significantly negative relationship between cognition and judgment or problem-solving scores (MMSE score: r= -0.684, $p<0.001$), and between cognition and functional status (MMSE scores: r= -0.588, $p=0.001$). Significantly higher FAQ mean scores (i.e., increased impairment) were observed among older adults with probable AD (18.7) and possible AD (17.3) than other types of dementia (e.g., semantic, Parkinson's disease dementia, Huntington disease) (16.1), but not for dementia with Lewy body (20.6), Vascular (21.1), and Frontotemporal (20.1). While higher judgment or problem-solving mean scores were demonstrated among older adults with probable AD (1.3) and possible AD (1.2) than other types of dementia (1.1), but not for dementia with Lewy body (1.7), Vascular (1.4), and Frontotemporal (1.3). In addition, 56% of the variance in judgment or problem-solving were predicted by both functional status and cognition (MMSE scores) (R^2=0.56; F(2, 3666)=2304.01, $p<0.001$). However, the study included several dementia subtypes, and did not specifically focused on the population of older adults with AD. Thus, results could not be generalized to older adults with AD.

Moreover, Nikolova, Demers, & Beland, (2009) examined the implications of various levels of cognitive decline (slight, mild, and catastrophic decline) on functional status in a longitudinal study among frail community-dwelling older adults (N=456), $\geq$ 65 years. The IADL was assessed using the 7-item IADL subscale of Older Americans

Resources and Services (OARS) while the ADL was measured using the Katz Index. The

study reported that abrupt cognitive decline influenced both the IADLs and ADLs in

older adults at an earlier stage (12 months), but the IADL is greatly affected than the

ADL. One reason associated to this is on the type of task. The IADL involves

complicated tasks that require greater cognitive functioning compared to the ADL. The

study also showed variation in cognitive decline among older adult participants at

different times and groups, which support Christensen (2001) and Comijs, Dik, Deeg, &

Jonker's (2004) previous works that the trajectory of older adults' cognitive decline vary

from very little to dramatic changes.

The risk of developing AD is highly correlated with age (Barnes & Bennett,

2014), such as the older the person, the more likely they are to experience a progressive

decline in cognition and function compared to younger groups. Nourhashemi et al. (2009)

and Masters, Morris, and Roe (2015) compared the progression of cognitive decline

among older adults. Nourhashemi and colleagues (2009) described and compared AD

progression between < 85 and ≥ 85 years older adults (N=686) who are in the community

(i.e., own homes) during study enrollment in a longitudinal French AD network study.

Participants have probable AD using the NINCDS-ADRDA criteria. Information was

collected through the informants. Katz Index was used to measure ADLs, such as

bathing, dressing, going to toilet, transferring, continence, and feeding. A higher score

indicates most independent while a lower score suggests most dependent older adults.

The MMSE, on the one hand, was used to measure cognitive status. Results showed that

the proportion of older adults ≥ 85 years have more rapid decline in ADLs and are more

dependent (p=0.006) than the younger age group. There was also a significant decline in

cognition between the two age groups, with a more rapid decline among ≥ 85 years than

< 85 years age groups. Similar with previous studies, this was not conducted among older

adult residents of congregate residential settings, but to community-dwelling older adults.

Consequently, Masters, Morris, & Roe (2015) conducted a study to observe the

decline of noncognitive symptoms among cognitively normal participants (N=2,416), >

50 years, who progressed to a Clinical Dementia Rating (CDR) > 0 (n=1,218) as well as

who remained CDR = 0 (n=1,198). The minority race of the former group consists of

13.3% (n=162) while the latter has 13.2% (n=158). Participants with CDR of 0 has

normal cognition, while 0.5 = very mild, 1 = mild, 2 = moderate, and 3 = severe

dementia. The study used longitudinal data from NACC UDS between Sept. 2005 and

March 2013. Participants have no functional limitations, depression, and other

neuropsychiatric symptoms (e.g., apathy, agitation, aggression, psychosis) at baseline.

Measures used include a 12-item informant-report Neuropsychiatric Inventory

Questionnaire (NPI-Q), to assess 12 domains of neuropsychiatric symptoms, a 15-item

self-report Geriatric Depression Scale (GDS), to assess older adults' depression, and a

10-item informant-report FAQ to assess IADLs. Results revealed participants who

progressed to CDR > 0 has a significantly greater decline in functional activities (i.e.,

IADL), positively developed depression, and experienced earlier neuropsychiatric

symptoms compared to those who did not progress (Masters, Morris, & Roe, 2015).

Study findings based on GDS showed that participants who progressed to CDR > 0 and

remained at CDR = 0 have significantly decreased energy and activity interest, and an

increased in the preference of staying at home. In sum, results from both NPI-Q and GDS

indicated that participants who have no depression symptoms at baseline developed

depression with increased age, but appears sooner to those who progressed to CDR > 0

(Masters, Morris & Roe, 2015). Similar with previous studies on depression and

dementia, this study is unclear whether depression is a result of a psychological process

or a manifestation of underlying diseases (Masters, Morris & Roe, 2015). There is also a

lack of literature in the relationship of functional activity and cognitive decline among

older adults diagnosed with AD in the congregate residential settings.

Lastly, older adults' functional activity level can be used to differentiate different

types of cognitive impairment. Teng et al. (2010) determined the performance of

Functional Activities Questionnaire (FAQ) in assessing older adults' (N=1,801) IADLs to

differentiate MCI (n=1,108) from very mild AD (n=693). Participants of the study are

mostly non-Hispanic White (MCI=77.1%; AD=84.4%), ≥ 50 years (mean age= 75.8

years in MCI; 76.8 years in AD). The study used longitudinal data from NACC UDS.

The FAQ was used to assess participants' IADLs while the MMSE was used to measure

cognitive impairment. The FAQ was administered to the informant, who is familiar with

the participants' activities in the past four weeks. Results showed that older adults with

AD have significantly greater FAQ total and mean item scores, which suggest greater

functional impairment compared to older adults with MCI. In the study, older adults with

a total FAQ score ≥ 6 have increased chances of being diagnosed with AD and an MCI

for < 6 total FAQ score. Results of the study communicated the utility of the FAQ

measure in assessing IADL and differentiating MCI from very mild AD. The result is

consistent with Marshall and colleagues' (2011) longitudinal study using data from older

adults (N=793) in the Alzheimer's disease Neuroimaging Initiative database, a

multicenter-observational trial. Although both works of Teng et al. and Marshall et al.

used multicenter, longitudinal data, they did not specifically determine any subgroup (i.e., race or ethnicity) who experienced the worst cognitive decline due to functional impairment.

The six studies mentioned to show the relationship of older adults' functional level and cognitive decline were in longitudinal design. Out of six studies, only two specified the inclusion of older African Americans while one study has an unspecified group of minority race. These three studies have mostly White participants. Also, three of the six studies have community-dwelling older adult participants, while five studies included participants with the diagnosis of MCI, AD, and dementia. No study specifically included congregate residential setting residents.

Conceptualization of cognition. Level of cognition refers to the five areas of cognitive function: memory, attention, processing speed, executive function, and language (Geerlings et al., 2000; Hassenstab et al., 2015; Folstein, Folstein, & McHugh, 1975; Tombaugh & McIntyre, 1992; Tombaugh, McDowell, Kristjansson, & Hubley, 1996). First, both episodic and semantic memory are affected in cognitive aging. However, the episodic memory is greatly affected in cognitive impairment due to AD. Episodic memory, a form of declarative memory (Eysenck & Keanne, 2015), consists of older adults' autobiographical information (Cavanaugh & Whitbourne, 1999). Recollection of episodic memory includes details of significant events at a specific time and place (Hofer & Alwin, 2008). Older adults with cognitive impairment due to AD experience more rapid and severe cognitive decline than older adults with normal cognitive aging. In support to this, Small, Perera, DeLaPaz, Mayeux, and Stern (1999) conducted a study to examine brain activity in groups of older adults with memory

decline due to AD (i.e., demented and non-demented). Results showed a reduction in

activity to both entorhinal cortex and hippocampus areas among older adults with

cognitive impairment due to AD during a face encoding task relative to non-demented

older adults.

Second, attention is a cognitive process that selects information within the

working memory for processing. Among the several types of attention (e.g., orientation,

selective, sustained, and divided), orientation is the most common. It refers to an older

adults' ability to focus on something and resist distractors (Cavanaugh & Whitbourne,

1999). Attention is related to functional status, which means that older adults with more

deficits in attention have greater functional impairment (Hofer & Alwin, 2008;

Swanberg, Tractenberg, Mohs, Thal, & Cummings, 2004).

Third, processing speed pertains to older adults' ability to learn or form new

associations. Processing speed is associated with age. This implies that as a person enters

old age, their ability to learn and process new information becomes slower (Cavanaugh &

Whitbourne, 1999).

Fourth, executive function (or central executive) is the most important component

in working memory. It is responsible for completing complex and goal-directed tasks,

such as planning, organizing, problem solving, and multi-tasking (Ahmed & Miller,

2011; Baddely, 1996; Carlson, Moses, & Claxton, 2004; Eysenck & Keanne, 2015). The

executive function involves three main processes: inhibiting, shifting, and updating

functions. Inhibition involves providing a dominant response, such as in the Stroop task

that asks the color the word was painted instead of the word itself. Shifting is more useful

in performing multiple tasks, which allows participants to switch between tasks. While

updating deals with deletion and addition of information (Eysenck & Keanne, 2015).

Lastly, language is a system of communication that involves grammar and syntax

(Eysenck & Keanne, 2015). In old age, language processing declines in relation to

cognitive changes (Cavanaugh & Whitbourne, 1999).

   Research has shown that aging slows the aforementioned five cognitive function

because of changes in the neuronal network and working memory. The neuronal network

changes involve the death of some neurons as well as the construction of new neuronal

pathways that are less efficient due to more neuronal connections (Cavanaugh &

Whitbourne, 1999). Further, as age increases, working memory declines that is

manifested in older adults' processing speed. Working memory is essential in encoding,

holding and retrieving information, solving problems, making decisions, and learning

(Cavanaugh & Whitbourne, 1999; Craik & Jennings, 1992; Salthouse, 1991).

   Cognition can also be associated with intellectual ability and the two dimensions

of intelligence (i.e., fluid and crystallized intelligence). The intellectual ability is best

measured using psychometric tests with a summary score, such as the intelligence

quotient summary score. Crystallized intelligence is associated to intentional learning

processes while fluid intelligence is related to casual learning processes (Cavanaugh &

Whitbourne, 1999). However, aging brings changes to these different types of

intelligence. The intellectual ability of a person, for instance, peaks in early adulthood,

but gradually declines as the age increases. The crystallized intelligence, which is

influenced by cultural knowledge, is expected to increase with age. Fluid intelligence, on

the one hand, is associated with older adults' physiological changes (Cavanaugh

&Whitbourne, 1999). Thus, as the person experiences more physiological impairment, fluid intelligence decreases.

The concept of cognition has been defined and interpreted in various ways, but this study focused on the five domains of cognition (e.g., memory, attention, processing speed, executive function, and language), rather than the two types of intelligence. These five domains were measured in the 30-item Mini-Mental State Examination.

Measures of Cognition. Different measures of cognition, such as the Mini-mental State Examination, Montreal Cognitive Assessment, Clinical Dementia Rating Scale, and the Neuropsychological battery, will be discussed in the succeeding paragraphs.

Mini-mental State Examination (MMSE). The MMSE is a simplified 11-item measure to examine older adults' mental status. The MMSE particularly focuses on cognitive function, such as orientation (10 points), registration (3 points), attention and calculation (5 points), recall (3 points), and language and visual construction (9 points) (Tombaugh & McIntyre, 1992). Total score for MMSE is 30, and scores < 25 are suggestive of mild impairment (Folstein, Folstein, & McHugh, 1975). Cutoff scores and interpretation of the MMSE are the following: 24-30 = no cognitive impairment, 18-23 = MCI, and 0-17 = severe cognitive impairment (Tombaugh & McIntyre, 1992).

Folstein and colleagues (1975) first used the MMSE to 206 participants with dementia and affective disorders (e.g., depression and schizophrenia), and 63 normal participants. With 24-hour apart, the measure obtained a test-retest reliability coefficient of 0.827 for 2 testers while a coefficient of 0.887 for one tester. Similarly, a high test-retest reliability coefficient of 0.99 was obtained in 28-day apart. Conversely, Pangman,

Sloan, and Guse (2000) administered the MMSE to 28 cognitively impaired, long-term

care residents, and obtained an internal reliability Cronbach's alpha coefficient of > 0.8.

Test-retest reliability taken at 1-week apart was found high, which ranges between a

correlation of 0.90 to 0.97.

   Internal consistency from diverse medical patients with mean age of 76 is

reported to be at Cronbach's alpha coefficient of 0.96, while coefficients of 0.68 (70-80+

years) and 0.77 (18-85+ years) were observed from community samples. The sensitivity

and specificity rates for MMSE has varied results, but mostly high. For instance, using

the psychiatric diagnoses, Folstein and colleagues (1975) obtained a 100% sensitivity and

specificity rates of MMSE for both cognitively intact and demented participants

(Tombaugh & McIntyre, 1992). With the DSM III criteria, Anthony, LeResche, Niaz,

Von Korff, and Folstein (1982) used the 23/24 cutoff MMSE score among 20-89+ years

cognitively intact and demented participants and obtained a sensitivity rate of 87% and a

specificity rate of 82%. With the DSM III criteria, Folstein, Anthony, Parhad, Duffy, and

Greenberg (1985) obtained a 100% sensitivity while 62% specificity rates for cognitively

intact and demented participants. Lastly, using the NINCDS-ADRDA criteria, the MMSE

obtained a 68% sensitivity rate while a 100% specificity rate for cognitively intact and

with AD participants (Galasko et al., 1990; Tombaugh & McIntyre, 1992).

   Further, the measure shows evidence of construct validity after comparing to

other instruments. To illustrate, cognitive tests, such as the Blessed Information Memory

Concentration test, has a correlation of -0.66 to -0.93 with the MMSE, while for

intelligence test, such as the Wechsler Adult Intelligence Scale revealed a correlation of

0.78 for verbal and 0.66 for performance scales. In addition, moderate to high

correlations were reported between MMSE and neuropsychological tests, such as Trails B

and Digit Span. The MMSE is also positively correlated with the ADL measures, with a

correlation between 0.40 to 0.75 (Tombaugh & McIntyre, 1992). More specifically, the

MMSE is highly correlated with more complex instrumental activities than basic ADLs.

In terms of concurrent validity, the MMSE shows correlation with the Wechsler Adult

Intelligence Scale (Folstein, Folstein, & McHugh, 1975).

In sum, MMSE, which is administered by trained personnel, is a valid and reliable

screening tool for detecting and differentiating dementia from other affective disorders. It

correctly identifies cognitively intact from cognitively impaired older adults as well as

distinguishes different types of cognitive impairment. It requires lesser administration

time (i.e., 5-10 minutes). Thus, it appears to be less demanding for older participants,

especially with shorter attention span.

Montreal Cognitive Assessment (MoCA). The MoCA is a 30-point measure that

assesses older adults' eight cognitive areas: visuospatial or executive (5 points), naming

(3 points), memory, attention (6 points), language (3 points), abstraction (3 points),

delayed recall (5 points), and orientation (6 points) (Nasreddine et al., 2005; Trzepacz,

Hochstetler, Wang, Walker, & Saykin, 2015). MoCA was developed to detect

impairment commonly seen in patients with MCI. The initial version assesses 10

cognitive domains, which was initially administered to 46 patients with MCI and AD.

The final version consists of items from eight cognitive domains that well discriminate

cognitively impaired from cognitively intact groups. Scores ≥ 26 suggests lesser

cognitive impairment, while lower scores suggest greater cognitive impairment. The

measure has a Cronbach's alpha coefficient of 0.83. It is also highly correlated with

MMSE (r=0.87, p<.001) (Nasreddine et al., 2005).

Clinical Dementia Rating (CDR). The CDR was developed as a staging measure,

not a diagnostic tool, to assess the severity of dementia of AD type (Chaves et al., 2007;

Mennella & Heering, 2015). It assesses six areas of older adults' cognition: memory,

orientation, judgment, problem-solving, community involvement, home and hobbies, and

personal care (Burke et al., 1988). The CDR total score comprises of five-point scale (i.e.,

0-3), with 0 = without dementia, .5 = questionable, 1 = mild, 2 = moderate, and 3 =

severe dementia (Burke et al., 1988; Mennella & Heering, 2015). A higher global score

indicates severe cognitive impairment while a low score suggests normal cognition. CDR

has an inter-rater reliability correlation of .91 (Burke et al., 1988). It can be administered

to older adults in semi-interview in different settings, such as the community, home, and

outpatient health care (Mennella & Heering, 2015).

Neuropsychological battery. The UDS neuropsychological battery is used to

measure older adults' five cognitive domains on memory, attention, processing speed,

executive function, and language (Geerlings et al., 2000; Hassenstab et al., 2015;

Folstein, Folstein, & McHugh, 1975; Tombaugh & McIntyre, 1992; Tombaugh,

McDowell, Kristjansson, & Hubley, 1996). Memory (i.e., episodic) is measured using the

Logical Memory Tests – immediate and delayed recall. Attention or working memory is

measured using the forward and backward Digit Span Tests. Processing speed is assessed

using the Digit Symbol and Trail Making (Part A) tests. Executive function is assessed

using Part-B of the Trail Making Test. While language domain is assessed using the

Boston Naming Test, and the animal and vegetable list generation (Weintraub et al.,

2009; Hassenstab et al., 2015). The UDS neuropsychological battery takes approximately

30-40 minutes to administer.

Chapter 3

Methodology

Research Design and Methods

This data-driven study was a secondary data analysis of existing data from the National Alzheimer Coordinating Center (NACC) Uniform Data Set to examine the relationships among extent of social support, extent of depression, level of functional activity, and level of cognition, among OAAs with a diagnosis of AD living in the congregate residential settings. This study used a cross-sectional design. Data available for secondary analysis in this study included respondents who met the following criteria: 1) 65 years and older, 2) lived in the congregate residential setting, 3) self-identified as African American, 4) understood and spoke English, and 5) diagnosed with AD (i.e., MMSE score < 26). Available variables from the original dataset for analysis included: social support (i.e., frequency of calls and visits received), depression, functional activity, and cognition.

There are four main reasons for choosing NACC data in this study. First, it clarified results from previous studies on the relationship of observed variables (i.e., extent of social support, extent of depression, level of functional activity, and level of cognition) among OAAs. The study had a homogenous sample, focusing only in the African American population, whom previous studies failed to give emphasis. This enhanced external validity (i.e., generalizability) of the results to OAA residents of the congregate residential settings. Second, the inclusion of social support as one of the study variables contributed new knowledge on its relationship to cognition since there are very limited studies on social support that used the same existing data. Third, the data are

collected at the national level from multiple Alzheimer's Disease Centers (ADCs) located

in different states. Participants were recruited through community organizations and

referrals, while some were volunteers who wanted to be part of the study (NACC, 2010).

The data consisted of diverse population from different geographical areas in the United

States. However, this study did not determine possible causes regardless how large the

relationship among observed variables (Cavanaugh & Whitbourne, 1999).

This study sought to answer the following research questions:

Research question 1: What are the relationships among social support (measured

by frequency of visits and frequency of calls, respectively), depression, functional

activity, and level of cognition in African American residents of congregate residential

settings?

Research question 2: Do psychosocial factors frequency of visits and frequency of

calls, depression, and functional activity predict the level of cognition? Which factor has

the strongest predictive power?

Research question 3: How does the extent of depression interact with frequency of

visits and frequency of calls, and level of functional activity to affect the level of

cognition?

The use of an existing data had several advantages. First, it possessed notable

quality as a product of allotted time spent by experienced (team) researchers who

collected and ensured the accuracy of the data. Proper documentation from skilled

personnel makes the data available for use to other researchers to either answer a

different set of research questions or cross-link information at different levels. Second,

analysis of existing data minimized the financial constraint from the researchers since

some data were readily accessible online at no cost after undertaking proper procedures.

Third, the secondary analysis of existing data increased the efficiency of the research

since it saved time (Cheng & Phillips, 2014; Grady, Cummings, & Hulley, 2013).

Source of the Data for Secondary Analysis

The NACC Uniform Data Set is an NIH-funded longitudinal project using

multiple sites to collect data annually from various ADCs across the country with

standardized instruments. The primary advantage of using the NACC Uniform Data Set

was that it provided exceptional quality of data from a project that was developed by a

group of research experts in the field, which could not be obtained by a sole researcher in

primary data collection for a short period of time (Vogt, Gardner, & Haeffele, 2012).

Also, it provided free standardized clinical data with rich information presented for over

34,000 research participants with mild AD and MCI enrolled in ADC for researchers to

complete a cost-effective study (Hassenstab et al., 2015). Although each ADC adapted its

own recruitment strategies/protocol (e.g., clinician referral, self-referral, active

recruitment in community organizations, and volunteering), researchers and trained

clinical personnel collected data using a standard and uniform approach to enhance

methodological rigor in data collection, and create more robust and valuable data.

Procedures of Obtaining the Original Dataset

The longitudinal Uniform Data Set data was accessed through contacting the

NACC national office at the University of Washington. A designated research consultant

accommodated and filed the data request once study variables were reviewed and

identified using the Uniform Data Set version-3 Researchers' Dictionary. A Uniform

Data Set version-3 codebook, with different forms used in data collection, was also

available online in the NACC website. A short description of the research proposal and a

signed Data Use Agreement were required to obtain data access. Once the request was

approved, data was delivered in approximately three days and was downloaded online

using assigned username and password. Lastly, this study sought approval from the

University of Missouri – St. Louis' Institutional Review Board to use the data from

NACC Uniform Data Set.

Procedures of Data Collection in the Original Dataset

The nationwide data collection was conducted in-person during office and home

visits, and telephone calls (NACC, 2010). Informed consent was obtained in written form

from both participants and co-participants to ensure they fully understand the purpose,

risks, and benefits of the research (Hassenstab et al., 2015; Weintraub et al., 2009). Data

collected in 2013 in active and inactive ADCs was included in the secondary analysis.

Further, the Uniform Data Set consisted of longitudinal clinical and cognitive

data, which were annually collected in a standard manner using uniform diagnostic

criteria across different ADCs (Morris et al., 2006) to facilitate tracking of cognitive and

functional decline among research participants. It was a standard instrument,

administered by trained clinicians in a structured interview (Weintraub et al., 2009) to

eligible research participants as required by the National Institute of Aging (Morris et al.,

2006).

The Uniform Data Set has three versions. Versions 1.1 and 1.2 differ mainly in

the administration instructions and scoring of evaluative forms. For instance, participants'

delayed story recall (i.e., Logical Memory A Delayed) in version 1.1 was evaluated

without a cue after 30 minutes while after a 20-minute delay in version 1.2, with a cue

from the story (Weintraub et al., 2009). However, versions 1.1 and 1.2 were no longer

collected. Version 3, on the one hand, was the latest version that consisted of major

revisions and being used in the current data collection.

More specifically, the data included participants' demographics, onset of

symptoms, medical history, medications taken, familial history of dementia, and different

neuropsychological measures, as well as co-participants' demographics, relation, and

observations to the participants' functional abilities (Weintraub et al., 2009). Co-

participants, who could be close friends and family, provided useful data that could help

monitor changes in the cognitive and functional abilities of the participants over time.

Also, the NACC Uniform Data Set was created primarily to provide cognitive and

functional information among participants with AD. It also included data from

cognitively healthy participants, with mild cognitive impairment, and different types of

dementia (Weintraub et al., 2009).

Each ADC has its own enrollment protocol that encompassed clinician referral,

self-referral or volunteering, and active recruitment in community organizations (NACC,

2010). It aimed to develop useful resources for researchers in the area to promote

exceptional research regarding risk factors, disease course, and progression of AD and

other types of dementia (Hughes, Peeler, Hogenesch, & Trojanowski, 2014).

Limitations of the Original Dataset

Although the Uniform Data Set was readily available to every esteemed

researcher, it had undoubtedly a number of challenges. It required a considerable amount

of time and hard work to prepare the data for the second analysis (Rantz & Connolly,

2004). The preparation consisted of the following processes: learning the background of

the data (e.g., forms and variables used), identifying discrepancies/differences between the three versions (i.e., UDS version 1.1, 1.2, and 3), sorting relevant variables, cleaning and screening the data to minimize bias interpretation of results, and if necessary recoding values of variables without losing its information (Vogt, Gardner, & Haeffele, 2012). Addressing these limitations, although it required immense time and commitment, assisted the researcher to own the data in preparation for secondary analysis.

Measures of Selected Study Variables

This section discusses the different measures of social support, depression, functional activity, and cognitive level that were used in the study.

Social support. Two questions were used to measure the structure of social support, frequency of calls and visits received as a form of social support, among OAA residents of the congregate residential settings from their social network. The item of frequency of calls and visits participants received in a month were classified into six levels, which range from 6 (more frequent) to 1 (less frequent) calls and visits (i.e., 6- daily, 5- at least three times/week, 4- weekly, 3- at least three times/month, 2- monthly, and 1- less than once a month). They were both structural measures of social support and quantitative in nature, which supported the main-effect model.

Depression. Geriatric Depression Scale (GDS) was used to measure the concept of depression. The GDS was a 15-item screening measure for depression (Brown, Sneed, Rutherford, Devanand, & Roose, 2014; Masters, Morris, & Roe, 2015). Each item had a "yes" or "no" response options with a score ranging from 0 to 15, with scores ≥ 5 categorized as the depressed group for purposes of research (Brown et al., 2014).

However, the GDS should not be used as a diagnostic instrument for depression

(Snowden et al., 2015).

   Further, the Geriatric Depression Scale (GDS) measure was validated for use

among older adults in different settings. For the institutionalized older adults, the GDS

has the following reliability: alpha coefficient = .99, test-retest reliability = .94 (Lesher,

1986; Montorio & Izal, 1996). While a sample of community dwelling participants, < 69

years, revealed a Cronbach's alpha coefficient of >.80 (Montorio & Izal, 1996; Rule,

Harvey, & Dobbs, 1989). Although GDS has no specific cutoff score, a cutoff score at 14

has a sensitivity between 55-100% for older adults with major depression and a

specificity of 81% (Lesher, 1986). A cutoff score of 11 yields a sensitivity rate of 69%

for subclinical depression and 100% for major depression, while it has a specificity rate

of 74% (Montorio & Izal, 1996). Despite its high reliability coefficients, the GDS

measure showed lower sensitivity (25%) and specificity (75%) when used with older

adults experiencing mild to moderate cognitive impairment (Kafonek et al., 1989;

Montorio & Izal, 1996).

   The Geriatric Depression Scale (GDS) measure was selected for use in the

Uniform Data Set because it involved enrollment of participants who are cognitively

intact and with cognitive impairment. Although the GDS is best used to assess depression

among cognitively intact older adults, it has still retained its validity for use among

cognitively impaired older adults, including in nursing home setting (Greenberg, 2012;

Marc, Raue, & Bruce, 2008; Wancata, Alexandrowicz, Margnart, Weiss, & Friedrich,

2006). It also showed convergent validity with Beck Depression Inventory ($r = 0.78$;

Montorio & Izal, 1996).

Functional activity. Functional Activities Questionnaire (FAQ) was used to

measure the concept of functional activity. The FAQ was a 10-item measure to assess

difficulties in the older adults' instrumental activities of daily living (IADL) (Master,

Morris, & Roe, 2015). The FAQ was administered to informants, and responses were

based on their observation and knowledge to older adults (Master, Morris, & Roe, 2015;

Teng et al., 2010) using 10 IADL categories that include: 1) ability to pay bills, 2)

completing tax or business records, 3) shopping, 4) playing games, 5) making coffee, 6)

preparing balanced meals, 7) tracking current events, 8) attending to TV programs,

books, and magazines, 9) remembering appointments, family occasions, and managing

medications, and 10) traveling outside the neighborhood (Brown et al., 2013, p. 677;

Teng et al., 2010, p. 350). Each category is rated from $0 - 3$ (0 = normal or no difficulty;

1 = has difficulty, but conducts by self; 2 = requires assistance; 3 = dependent; Teng et

al., 2010). There are no specific cut-points for FAQ scores, but older adults have higher

likelihood of being diagnosed with AD when their total FAQ score is ≥ 6, and a mild

cognitive impairment for a total FAQ score of < 6 (Brown et al., 2014; Teng et al., 2010).

The earlier works of Pfeffer et al. (1982) has shown that FAQ measure, which

could be administered within 10 minutes, demonstrated concurrent validity and more

sensitivity for detecting IADL impairment between cognitively normal and demented

older adults. The FAQ was validated for the older adult population and effectively

discriminated cognitively normal from demented older adults, with a sensitivity between

85-98% and specificity between 71-91% (Brown et al., 2014; Teng et al., 2010). The

FAQ items were highly correlated with the IADL score ($r = .72$, 95% CI = .64 - .79). The

items also have high correlations with the total FAQ scores (i.e., between .80 - .90) as

well as with the IADL total scores (i.e., .52 - .71).

      Cognition. The MMSE, a 30-point questionnaire, was used to systematically and

thoroughly assess cognitive status of the older adults. It was an 11-item measure that tests

five areas of cognitive function: orientation, registration, attention and calculation,

memory, and language and visual construction (Folstein, Folstein, & McHugh, 1975;

Tombaugh & McIntyre, 1992). An older adult could obtain a lowest score of 0, which

indicates too cognitively impaired, and a highest score of 30 that suggests no cognitive

impairment (Jutkowitz et al., 2016; Tombaugh & McIntyre, 1992). A score of < 25

supports the older adults' diagnosis of early-stage AD (Kurlowicz & Wallace, 1999). The

MMSE is the recommended test for cognitive impairment (Rait et al., 2005). It has high

sensitivity for people with AD (Tombaugh, McDowell, Kristjansson, & Hubley, 1996)

and has moderate to high Cronbach's coefficient alpha (i.e., internal consistency), .74 -

.90, among older participants with cognitive impairment due to AD and other types of

dementia (Tombaugh & McIntyre, 1992). It also has moderate-to-high levels of

sensitivity and specificity (Tombaugh & McIntyre, 1992; Tombaugh, McDowell,

Kristjansson, & Hubley, 1996).

      Specifically, the MMSE's internal consistency (i.e., item homogeneity) showed

varied results that range from .68 to .96. The modest alpha levels of .68 (ages 70 - 80+)

and .77 (ages 18 - 85+) were obtained from community samples while the highest level of

.96 was from a group of medical patients (*M* age = 76; Tombaugh & McIntyre, 1992).

The work of Jorm, Scott, Cullen, and MacKinnon (1991) showed the relationship

between alpha levels and years of education, with a higher alpha level of .65 noted

among community sample with only a primary education compared to an alpha level of

.54 for a community sample with eight or more years of education. The MMSE's test-

retest reliability ranges between .80 and .95 for both cognitively healthy and impaired

samples. For instance, medical patients with dementia, depression, and schizophrenia (*M*

age = 74) have a correlation coefficient of .99 (Folstein, Folstein, & McHugh, 1975)

while a mixed sample of dementia, delirium, and cognitively intact participants aged 58-

86 have a correlation coefficient of .94 (Pfeffer et al., 1984). The work of Kafonek et al.

(1989) among participants with dementia, delirium, and depression reported a correlation

coefficient of .84 while Morris et al. (1989) reported a correlation coefficient of .74 and

.79 to a sample of participants (*M* age = 72) with mild and moderate AD respectively.

Lastly, MMSE has high sensitivity (100%) and specificity (100%) for both

cognitively intact (*M* age = 74) and dementia (*M* age = 80) samples (Tombaugh &

McIntyre, 1992). The work of Galasko et al. (1990) also reported a moderate to high

sensitivity (68%) and specificity (100%) for both cognitively intact and AD samples.

Although the MMSE measures the severity of cognitive impairment, it should not be used

solely as a diagnostic instrument to identify dementia (Tombaugh & McIntyre, 1992).

Socio-demographic variables. Socio-demographic variables included self-report

of age, gender, level of education, and presence of comorbidity (Ayalon, 2013). For the

purpose of this research study, age referred to the older age group, ≥ 65 years, at baseline

(Ayalon, 2013). It was measured through a self-report of a total number of years a

participant has since birth (Ayalon, 2013, p. 1289; Ayalon & Arean, 2004, p. 52; Singh &

Bajorek, 2014). Gender was defined as either male or female that the participants self-

identified (Kawachi & Berkman, 2001). The level of education referred to the

participants' amount of formal schooling. It was reported in a number of years of formal

schooling a person has (Barnes & Bennett, 2014; Imtiaz, Tolppanen, Kivipelto, &

Soininen, 2014; Shoemaker, Tankard, & Lasorsa, 2004). Comorbidity was the

coexistence of multiple impairments that is a total burden of biological dysfunction and

complicates OAAs' health condition (Karlamangla et al., 2007, p. 296). Older

participants' health history was used to measure self-reported coexisting diseases.

Ethical Considerations

Data requested from the NACC was stored in a hard drive and password protected

computer, and was used in accordance with the signed Data Use Agreement. The

researcher, who has taken the Institutional Review Board ethics training, has the only

access to the hard drive and the password (computer). The researcher did not attempt to

identify the specific ADC and its participants to maintain confidentiality and anonymity

throughout the research process.

Data Analysis

Prior to data analysis, exploratory data analysis was used to assess the nature of

the dataset (e.g., outliers), inspect the distribution of missing data across study variables,

and select appropriate statistical techniques for handling missing data. Based on results of

exploratory data analysis, data-driven approach was used to implement appropriate

statistical techniques for secondary analysis of available data. Level of significance was

set at $p<.05$. All analyses were conducted using IBM SPSS software version 22.

Multiple imputation. Multiple imputation (Rubin, 1978) was used to handle the

missing data. In this method, the observed missing values did not exhibit an MCAR

(missing completely at random) pattern where the pattern of missing values did not

depend on data values (Enders, 2010). Multiple imputation is a powerful tool to handle

missing data (Lang & Little, 2016). It includes three steps: imputation, analysis, and

pooling phases. The imputation phase creates replacements for the missing data to

generate multiple imputed data sets. The analysis phase involves fitting of the replicates

to the imputed data sets. While the pooling phase creates final pooled point estimates and

standard errors (Enders, 2016; Lang & Little, 2016).

More specifically, in this study, the missing data values were first tested using the

Little's test if they exhibit an MCAR pattern (Enders, 2010). The missing data appeared

to not exhibit an MCAR pattern. Thus, multiple imputation for continuous variables was

used to generate multiple complete data sets with the missing values imputed according

to an automatically selected procedure in SPSS version 22 (i.e., either expectation

maximization or regression method). Twenty imputed data sets were generated for this

study. The results from these imputed data sets were combined (pooled) using Rubin's

rules (Rubin, 1987) for overall inference in a way that accounts for the variability

between imputations. A normalizing transformation was applied to the correlation

coefficient before Rubin's rules could be applied in the combination (Ratitch, Lipkovich,

& O'Kelly, 2013). Results for this study were based on the overall inference.

Descriptive statistics. Descriptive statistics reports were run, and frequency

tables were constructed that helped explain the demographic characteristics of the

participants. Frequency tables were used to describe patterns of categorical variables

(e.g., socio-demographics) included in the study through measures of central tendency

(i.e., mean, median, mode) and dispersion (i.e., range, standard deviation).

Correlational statistics. Correlational statistics were used to answer research question 1 with continuous outcome variables (Creswell, 2014; Gliner, Morgan, & Leech, 2009). Both the Pearson and eta coefficients were reported to show correlations among the variables. More specifically, the Pearson coefficients were reported to show the correlation among continuous variables while the eta coefficients were used to show the correlation between continuous and categorical variables.

Hierarchical multiple regression. Further, hierarchical multiple linear regressions were used to answer the second research question. It showed how much of the variance (R^2) in the outcome variable could be explained by the predictor variables (Kahane, 2008), controlling for the effects of person (i.e., age, gender, level of education), environment, and health and illness (i.e., comorbidities) factor variables. An R^2 with a large value (i.e., close to 1 or 100%) indicates the regression line is a good fit (Kahane, 2008).

In this study, the socio-demographic variables were treated as background variables or covariates and were controlled for their effects (Meyers, Gamst, & Guarino, 2013). A two-stage hierarchical multiple regression was performed to examine the relationship between level of functional activity and level of cognition. In the first stage, the covariates (i.e., age, level of education, gender, comorbidities) were entered in the first block to statistically control for its effects (Meyers, Gamst, & Guarino, 2013) while the psychosocial variables (frequency of visits, frequency of calls, depression, functional activity) were individually entered in the second block to obtain results. The goodness of model fit, and both R^2 and R^2 change were reported. Finally, to answer the third research question, a moderation analysis was conducted where the continuous predictor variables

were centered (i.e., predictor variable minus its mean) prior to conducting the regression

analysis to test for any interaction.

Chapter 4

In this chapter, sample characteristics were described and measures were reviewed. Results from both descriptive and inferential statistics were presented to answer the research questions of the study. A figure presents a flowchart showing how the sample was selected for this secondary analysis. A table of correlations that describe the relationships among study variables was reported.

Results

Figure 2 presents a flowchart showing how the sample of 56 from year 2013 was selected from the large NACC Uniform Data Set that originally had 12, 823 participants from all races between 2005 and 2016 for this study. The chosen sample of 56 from year 2013 for a cross-sectional analysis was based on the data-driven approach in which the participants met inclusion criteria and the sample size met the requirement of at least ten cases per independent variable (Knofczynski & Mundfrom, 2008; Siddiqui, 2013) for a cross-sectional analysis of multivariate models to answer research questions 2 and 3.

The process of pre-screening eligibility started with the criterion of race. Only 1,200 out of 12,823 participants were African Americans. Of the 1, 200 African Americans, only 541 were ≥ 65 years of age and had a diagnosis of AD living in congregate residential settings. Excluded years were 2005-2011 that had data older than 5 years, 2014-2016 that had less than 50 participants, and 2012 that had only 23 participants participated in the next year, though it had the second largest sample. Finally, data included in the cross-sectional analysis were 56 participants from year 2013 who were ≥ 65 years of age and had a diagnosis of AD living in congregate residential settings.

Figure 2

Selected Sample Flowchart

All Races 2005 – 2016 **N = 12,823**	
Yes	
African Americans (AAs) *1,200*	*Excluded other races* *11,623*
Yes	
AAs with Alzheimer's disease *959*	*Excluded AAs without Alzheimer's* *241*
Yes	
AAs in congregate residential settings *547*	*Excluded ineligible AAs* *412*
Yes	
AAs aged ≥65 years *541*	*Excluded data > 5 years old (2005 – 2011)* *328*
Yes	
AAs met full criteria for testing models with 4 independent variables *213*	*Excluded years with n < 50* *2014 46* *2015 43* *2016 14*
Yes	
Screening data for consideration of longitudinal analysis consideration *110*	*Exclude 2012 (n = 54)* *Only 23/54 in 2012 participated in 2013*
Yes	
Selected 2013 (n = 56) *for cross sectional analysis*	

Sample Characteristics

Results of this secondary analysis were based on the 2013 National Alzheimer's

Coordinating Center (NACC) Uniform Data Set from 56 participants aged ≥ 65 years

who were self-identified as African American, residing in a congregate residential

setting, and diagnosed with Alzheimer's disease. Table 2 demographic characteristics of

participants and their relationship to co-Participants.

Table 2

Demographic Characteristics of Participants and their Relationship to Co-Participants

Description	NACC 2013 (n=56)	
Continuous Variables	*M / SD*	Range
Age (in years)	81.7 / 7.8	65 – 99
Education (in years)	13.8 / 4.2	5 – 27
Total no. of comorbidities	2.1 / 1	0 – 4
Categorical Variables	*f*	%
Gender		
Male	15	26.8%
Female	41	73.2%
Marital Status		
Married	19	33.9%
Widowed	19	33.9%
Divorced	12	21.4%
Separated	0	0%
Single, never married	6	10.7%
Comorbidity		
Stroke	9	16.1%
Diabetes	18	32.1%
Hypertension	51	91.1%
Hypercholesterolemia	38	67.9%
Level of Independence		
Independent	9	16.1%
Assistance with complex activities needed	18	32.1%
Assistance with basic activities needed	8	14.3%
Completely dependent	21	37.5%
Congregate Residential Settings		
Retirement community or	25	44.6%

independent group living		
Assisted living, adult family home, or boarding home	12	21.4%
Skilled nursing facility, nursing home, hospital, and hospice	19	33.9%
Relationship of the co-participants		
Spouse/partner/companion	15	26.8%
Adult Child	24	42.9%
Sibling	2	3.6%
Relative	8	14.3%
Friend, neighbor, or someone known via family, friends, work, or community	2	3.6%
Paid caregiver, health care provider, or Clinician or other	5	8.9%

There were more women (n = 41; 73.2%) than men (n = 15; 26.8%) in this study, with a mean age of 81.7 years old, ranging from 65-99. Overall, the participants had 13.8 years of education, ranging from 5-27, with over one-third of the participants (n = 20; 35.7) had 16 or more years of education. The number of participants (n = 19; 33.90%) who were still married and/or widowed is the same, whereas 12 (21.40%) were divorced.

The majority of the participants had at least one comorbid condition, with 51 had a history of hypertension and 38 had a history of hypercholesterolemia. In addition, less than one-fifth of the participants (n = 9; 16.1%) were able to live independently. Over one-third participants either needed some assistance with complex activities (*n*=18; 32.10%) or were completely dependent (*n* = 21; 37.50%). Over half of participants (n = 25; 44.6%) lived in the retirement community or independent living, while over one-third (n = 19; 33.9%) lived in skilled nursing facility, nursing home, hospital, and hospice.

Among 56 co-participants who provided data on comorbidities and functional activity,

almost half of them (n = 24; 42.9%) were adult children, followed by

spouse/partner/companion (n = 15; 26.8%).

Descriptive Statistics of Selected Study Variables

Table 3 below lists the mean, standard deviation, and range of the selected study

variables. On average, the participants received at least 3 times/month to weekly visits or

calls form their social network, had no severe depressive symptoms (i.e., 5-8 = mild, 9-11

= moderate, 12-15 = severe depression; Greenberg, 2012), and needed assistance to be

able to perform instrumental activities of daily living (i.e., 0 = normal or no difficulty, 1

= has difficulty, but conducts by self, 2 = needs assistance, 3 = dependent; Teng et al.,

2010).

Table 3

Descriptive Statistics of the Selected Study Variables.

Description	NACC 2013 (n=56)	
Independent Variable	*M / SD*	**Range**
Frequency of visits	3.72 / 1.46	1- 6
Frequency of calls	3.71 / 2.06	1 - 6
Depression	1.86 / 6.70	0 - 13
Functional Activity	2.06 / 1.03	0 - 3
Dependent Variable		
Cognition	14.88 / 10.36	0 - 29

Note. *Frequency of visits and frequency of calls: 6 = Daily, 5 = At least 3 times/week, 4*

= Weekly, 3 = At least 3 times/month, 2 = Monthly, and 1 = Less than once a month

Psychometric Properties of Measures

Table 4 presents the psychometric properties of three standardized scales,

measuring the variables of depression, functional activity, and cognition. Due to the

availability of items for estimating internal consistency reliability in the NACC Uniform

Data, Cronbach's alpha was obtained for the Geriatric Depression Scale and the

Functional Activities Questionnaire in this secondary analysis. Both appeared to be

reliable tools as the Geriatric Depression Scale obtained a Cronbach's alpha of .85 and

the Functional Activities Questionnaire obtained a Cronbach's alpha coefficient of .96.

As far as the Mini–Mental State Examination (MMSE) or Folstein test that has been used

extensively in clinical and research settings as a screening tool for cognitive impairment,

a range of internal consistency reliability estimates as cited in the literature were included

in Table 4.

Table 4

Psychometric Properties of Measures

Variable	n	M/SD	No. of Items	Item Scale	Total Possible Points	α
Standard Measure						
GDS	56	1.86/13.60	15	Dichotomous	15	.85
FAQ	56	2.06/1.03	10	Likert	30	.96
MMSE	56	14.88/13.24	11	Mixed	30	.74-.90

Note. GDS = the Geriatric Depression Scale measuring depression; FAQ = the Functional

Activities Questionnaire measuring functional activity; MMSE = the Mini–Mental State

Examination (MMSE) or Folstein test measuring cognition; n = sample size; M =mean;

SD = standard deviation.

Findings with Respect to Potential Covariates

The correlations among the covariates and study variables were examined.

Pearson correlations were used to examine associations between continuous variables,

including age, education, frequency of visits, frequency of calls, depression, functional

activity, and cognition. Cross-tabulation were used to examine the eta coefficients for the

association between categorical variables, such as gender and comorbidities, and

continuous variables, frequency of visits, frequency of calls, depression, functional

activity, and cognition.

Table 5

Correlation Estimates Between Covariates and Study Variables

	Frequency of visits	Frequency of calls	Depression	Functional Activity	Cognition
Age	-.04	-.03	-.04	.10	-.20
Education (in years)	-.03	-.22	-.06	-.05	.19
Gender	.19	.19	.04	.03	.08
Total Comorbidities	.04	-.11	-.04	.14	-.09
Stroke	.09	.12	.10	.19	.05
Diabetes	.13	.04	.11	.19	.12
Hypertension	.05	.08	.20	.19	.06
Hypercholesterolemia	.05	.18	.09	.06	.09

Note. Visits=frequency of visits, higher scores indicate higher social support; Calls =

frequency of calls, higher scores indicate higher social support; Functional activity:

lower scores=higher capability; Depression: higher scores=more depressed; Cognition:

higher scores=better cognition. All test of significance was set at p<.05.

Findings with Respect to Research Question 1

Bivariate Pearson correlations were used to answer **research question 1:** What

are the relationships among frequency of visits, frequency of calls, depression, functional

activity, and level of cognition in African American residents of congregate residential

settings?

Table 6 below shows that the frequency of calls had a moderately strong negative

correlation with functional activity (*r*= -.46, *p*<.01), and was strongly and positively

correlated (*r*= .46, *p*<.05) with cognition. The findings suggest that those who received

higher frequent calls had less difficulty with functional activities. Also, those who

received higher frequent calls had higher level of cognition. In addition, there is a

negative association between frequency of visits and cognition (*r*= -.16), but it is not

significant.

Table 6

Correlation Estimates among Study Variables

	Visits	Calls	Depression	Functional Activity	Cognition
Visits	1				
Calls	.05	1			
Depression	.14	.39	1		
Functional Activity	.20	-.46**	-.25	1	
Cognition	-.16	.46*	.30	-.66**	1

Note. Visits=frequency of visits, higher scores indicate higher social support; Calls =

frequency of calls, higher scores indicate higher social support; Functional activity:

lower scores=higher capability; Depression: higher scores=more depressed; Cognition:

higher scores=better cognition. *p<.05 **p< .01

While there is insufficient evidence statistically supporting any correlations with

other study variables, functional activity was significantly negatively correlated with

level of cognition (r= -.66, $p<.01$). This finding – coupled with the opposing direction in

the associations between the frequency of calls and level of cognition (r=.46, $p<.05$), and

between frequency of visits and level of cognition (r= -.16) – further suggest those who

had higher level of cognition had received less frequent visits while they received more

frequent calls. Furthermore, there was a significant, negative correlation between the

level of functional activity and level of cognition (r= -.66, $p<.01$). This finding suggests

that those who could normally perform activities of daily living (ADLs) and Instrumental

Activities of Daily Living (IADLs) were more likely to have higher level of cognition.

Table 7

Correlation Estimates Between Level of Functional Activity Items and Level of Cognition

	Correlation	p
Bills	.50	$p < .05$
Taxes	.51	$p < .05$
Shopping	.59	$p < .01$
Games	.68	$p < .01$
Stove (making coffee)	.64	$p < .01$
Meal preparation	.58	$p < .01$
Events	.59	$p < .01$
Pay attention	.65	$p < .01$
Remember dates	.59	$p < .01$
Travel	.46	$p < .05$

In addition, eta coefficients of Crosstabs, alternatively the General Linear Model, show *(Table 7)* that all 10 items in the level of functional activity measure were significantly correlated with level of cognition. Crosstabs present the eta coefficients while the General Linear Model provides the eta square, an index of strength of effect (Meyers, Gamst, & Guarino, 2013) and the *p* -values. In this study, the eta, which is a correlation coefficient, was used to measure the association between categorical (i.e., functional activity items) and continuous (i.e., cognition) variables.

As shown in Table 7, the 10 items of functional activity were significantly positively correlated with level of cognition. Results indicate that older adults who can normally pay their bills, complete tax, shop, play games, make coffee, prepare meals, track events, pay attention to TV programs, remember appointments, and travel outside the neighborhood, have high levels of cognition while those with low levels of functional activity have low level of cognition.

Findings Related to Research Question 2

Hierarchical multiple regression was used to answer **research question 2:** Do psychosocial factors (social support, depression, and functional activity) predict the level of cognition? Which factor has the strongest predictive power? After controlling for the covariates (age, gender, education, and comorbidities-- stroke, diabetes, hypertension, hypercholesterolemia), results show that two psychosocial factors (the extent of social support and the level of functional activity) statistically significantly predict the level of cognition *(Table 8 and 9)*.

As shown in Table 8, the extent of social support has an R^2 of .44, which means that 44% of the variance in the level of cognition can be explained by social support.

Additionally, functional activity has an R^2 of .58, which indicates that functional activity

was able to explain 58% of the variance of level of cognition. Level of functional activity

has the strongest predictive power to level of cognition.

      Prediction of social support on cognition. Results from the two-stage

hierarchical multiple regression *(Table 8)* showed that at stage one, the covariates (i.e.,

age, level of education, gender, and comorbidities) accounted for 12% of the variance of

the level of cognition, but they did not significantly contribute to the model $F(7, 48) = .97$,

$p=.46$. Introducing frequency of visits and frequency of calls in the second block of the

hierarchical multiple regression for stage 2 revealed that social support significantly

contributed to the model, $F(9,46)=4.16$, $p<.01$, with an R^2 of .44, adjusted $R^2=.33$. This

indicated that the inclusion of social support in the model explained 44% of the variance

in level of cognition, with an R^2 change of .32.

Table 8

Extent of Social Support and Level of Cognition

	Cognition		
Predictor	ΔR^2	B	SE B
Step 1	.12		
Control variables			
Step 2	.32**		
Visits		-1.36	1.43
Calls		2.74**	.87
Total R^2	.44**		
n	56		

*p<.05 **p<.01

Note: Control variables include age, education, gender, and comorbidities (stroke,

diabetes, hypertension, hypercholesterolemia); Visits=frequency of visits;

Calls=frequency of calls; Social support: higher scores=higher social support.

The findings showed that older adults with greater social support have a higher level of cognition. This further suggests that the extent of social support predicted the level of cognition after controlling for the effects of age, gender, education, and comorbidities (i.e., stroke, diabetes, hypertension, hypercholesterolemia). The model as a whole is statistically significant with a large magnitude of effect ($R^2 > .40$) (Meyers, Gamst, & Guarino, 2013).

More specifically, frequency of calls was statistically positively related to level of cognition with a *b* weight coefficient of 2.74, $p < .01$. In this study, the higher value on frequency of calls means more frequent calls. Results suggest that older participants who received more frequent calls have higher level of cognition compared to those who received less frequent calls. Further, frequency of visits is not significantly associated to level of cognition with a *b* weight coefficient of -1.36, $p > .05$.

Prediction of functional activity on cognition. Results from the two-stage hierarchical regression (*Table 9*) showed that the covariates accounted for about 12% of the variance in level of cognition, but it was not statistically significant, $p = .46$. The first model was not significant, $F(7, 48) = .97$, $p = .46$. At stage two, level of functional activity was entered in the second block of the model controlling for the effects of the covariates. Results showed that the second model was statistically significant, $F(8, 47) = 8.47$, $p < .01$, with an R^2 of .58, adjusted $R^2 = .51$. A high R^2 with a large magnitude of effect of .58 indicates that 58% of the variance of level of cognition can be explained by the level of functional activity.

Table 9

Level of Functional Activity and Level of Cognition

	Cognition		
Predictor	ΔR^2	B	SE B
Step 1	.12		
Control variables			
Step 2	.46**		
Functional activity		-7.22**	1.61
Total R^2	.58**		
n	56		

*p<.05 **p<.01

Note: Control variables include age, education, gender, and comorbidities

(stroke, diabetes, hypertension, hypercholesterolemia).

Also, the introduction of level of functional activity in the model has significantly

raised the R^2 by .46 (46%), *p<.01*. Level of functional activity has statistically contributed

to the model with a *b* weight coefficient of -7.22, *p<.01*. Results further suggest that the

level of functional activity predicted the level of cognition after controlling for the effects

of age, education, gender, and comorbidities. Functional activity had a significantly

negative relationship with level of cognition. In the level of functional activity, a lower

value means that older adults can normally perform the IADLs while a higher value in

the level of cognition suggests higher cognition. Thus, the results supported the

hypothesis that older adults with high level of functional activity (i.e., lower FAQ score)

have a high level of cognition (i.e., higher MMSE score). This also means that older

adults who still perform some IADLs have better level of cognition than those who could

not. Alternatively, as the level of average functional activity decreases by one unit, the

level of cognition increases on average by 7.22. Finally, no multicollinearity was

observed among the predictors, including the covariates, in the second model (i.e., VIF <

2). However, there is insufficient evidence to statistically support the following three hypotheses:

Ha1: Older adults with greater extent of social support (measured by frequency of visits and frequency of calls, respectively) have lower extent of depression.

Ha2: Older adults with lower extent of depression have higher level of functional activity.

Ha3: Older adults with lower extent of depression have higher level of cognition.

Findings Related to Research Question 3

Research question 3: How does the extent of depression interact with social support and level of functional activity to affect the level of cognition?

Possible interactions for depression with the extent of social support and level of functional activity were examined through moderation. In these analyses, the continuous predictor variables were centered prior to conducting regression analyses to test for any interaction. Unexpectedly, the interaction terms for both extent of depression and extent of social support, and extent of depression and level of functional activity were not statistically significant. Thus, extent of depression did not interact with extent of social support and level of functional activity in this study.

Chapter 5

Discussions, Implications, and Conclusion

In this chapter, a brief summary of the study was presented. Results of the study were discussed. Implications to the co-participants, family, health care providers, policy makers, and researchers were described. Limitations and recommendations of the study were addressed.

Brief Summary of the Study

The purpose of this study was to examine the underlying associations among extent of social support, extent of depression, level of functional activity, and level of cognition in OAAs, ≥ 65 years, with a diagnosis of Alzheimer's disease (AD) living in the congregate residential settings. The main effect model of social support was used to guide this study, which postulates that social support network provides beneficial effects to individuals whether under stress or not (Kawachi & Berkman, 2001). The model is based on the Relational Regulation Theory that helps explain the relationship of social support to level of cognition.

AD is an irreversible deterioration of cognitive functioning (Alzheimer's Association, 2015). There are over five million people living with AD in the United States (Alzheimer's Association, 2015; Barnes & Bennett, 2014), which will continue to grow as the aging population increases in the next decades. Thus, it is imperative to focus on factors that could help prevent or at least delay the cognitive decline experienced by people with AD through looking at the psychosocial factors. In this study, these factors refer to social support, depression, and functional activity.

Older African American participants in this study were part of the 2013 NACC Uniform Data Set, aged ≥ 65 years, a resident in a congregate residential setting, and had a diagnosis of AD. Most of the older participants were women. The participants' overall average years of education was 13.8 years. Also, most of the participants were married, except for six who were never married. In terms of level of independence, less than one-fifth were able to live independently, while the rest of the participants needed some assistance. Further, most of the older participants lived in the retirement community or independent living, while 12 lived in the assisted living, adult family home, or boarding home, and 19 in the skilled nursing facility, nursing home, hospital, and hospice. Each older participant had a co-participant, who provided data on comorbidities and functional activity. Most of these co-participants were adult children, followed by spouse, partner or companion, other relatives, other, sibling, friend or neighbor, and paid caregiver.

Results indicate that the frequency of calls negatively correlated with functional activity but positively correlated with cognition, whereas the frequency of visits negatively correlated with cognition. In addition, functional activity was negatively significantly correlated with cognition.

Results of the two-stage hierarchical regression support two predictive models proposed in this study: social support predicted cognition and functional activity predicted cognition. After controlling the covariates (i.e., age, level of education, gender, and comorbidities), evidence of significant predictive power from social support to level of cognition suggests that those with higher extent of social support (i.e., frequency of calls) tend to have higher level of cognition. Similarly, evidence of significant predictive

power from functional activity to cognition suggests that those who could still perform

some IADLs tend to have better level of cognition.

Discussion of Findings

As with the literature (Chronister et al., 2015; Ozbay et al., 2007), social support

correlated with functional activity. Especially, those who received more phone calls were

more likely to have less difficulty to perform functional activity and more likely to have

better cognition. There is a substantial evidence that social support is key for maintaining

physical health (Chronister et al., 2015; Ozbay et al., 2007). Social contacts, such as receiving

phone calls, are forms of social support and appear to be beneficial for older adults living

with chronic conditions, including AD (Antonucci & Akiyama, 1987; Barnes, de Leon,

Wilson, Bienias, & Evans, 2004; Zahodne, Nowinski, Gershom, & Manly, 2014). Rovner

et al. (2016) examined the relationship between cognitive or social and physical activities

with cognition among community-dwelling OAAs and found that participation in

cognitive or social and physical activities, such as board games, cooking, and going to

church, were positively related to executive function. This suggests that older adults with

increased participation on cognitive or social activities may display higher attention,

cognitive flexibility, perceptual-scanning skills, and processing speed. Overall findings

support the literature (Crooks, Lubben, Petitti, Little, & Chiu, 2005) that social support

plays a protective role for people living with dementia. Research has shown that higher

frequency of contacts by phone or visits (i.e., daily) decreased the risk of dementia

(Rovner, Casten, & Leiby, 2016). Clarke et al. (2015) noted that social interaction slows

the rate of cognitive decline. However, the type of support provided and the satisfaction

of received support were not measured. Thus, we do not know the nature of every social

interaction older adults received from their co-participants. For instance, emotional

support, which is the availability of someone to listen to one's problem with empathy,

caring, and understanding is positively related to executive functioning. This further

suggests older adults with higher emotional support have greater executive functioning

(i.e., task switching) and processing speed (Zahodne et al., 2014). Another, negative

social interaction can be a risk factor for cognitive decline. For instance, Wilson et al.

(2015) examined the association of negative social interaction with the risk of MCI and

cognitive decline among older adults and found that higher level of negative social

interaction is associated with increased rates of MCI and cognitive decline. These factors

were not measured in the present study. Thus, it needs further investigation and is part of

the limitation of the study.

Results of this study support the importance of social support in preventing or

delaying cognitive decline among older adults, especially those who are experiencing AD

(Livingston et al., 2017). Social support, which can be in the form of social participation

or engagement, prevents social isolation that can result in cognitive inactivity and faster

cognitive decline (Livingston et al., 2017). Social support can be incorporated in the care

of older adults. It can be part of their individualized health care plan. Efforts to increase

social support and social participation by the older adults and their formal and informal

caregivers are imperative to help delay cognitive decline. Facility-wide programs, such as

social gathering and playing games, that enhance social ties among the older adults can

be implemented. Families and friends need to be encouraged to include provision of

social support as their priority by means of making contact (i.e., telephone calls) to older

adults, especially if the older adult is at risk for developing dementia. Both the older adult

and their families can be informed of the benefits of social support and social engagement as it helps delay cognitive decline and enhance mental stimulation.

Findings in Relation to Depression

Depression is a disorder that displays symptoms (e.g., feelings of sadness, loss of pleasure, and fatigue) that disrupt older adults' cognitive, physical, psychological, and social function (Bressert, 2017; Greenberg, 2012). For this study, it was measured using the 15-item Geriatric Depression Scale-Short Form. After depression was added to the analyses and covariates were controlled in the model, depression had no statistical association with level of cognition. In addition, findings of the relationships between social support and depression, depression and cognition, and depression and functional activity were not statistically significant. These unexpected findings might be due to the following possible explanations. First, although the literature demonstrates that OAAs have similar or greater risk for depression than Caucasian older adults due to poorer health status and higher comorbidities (Blazer, Landerman, Hays, Simonsick, & Saunders, 1998; Mills, Alea, & Cheong, 2004; Mills & Edwards, 2002), OAA women seem to report lower rates of depression than their Caucasian counterparts (Blazer, Burchett, Service, & George, 1991; Mui & Burnette, 1996). This finding from the literature is reflected in the findings of this study because the participants consisted of mostly women (71%). Second, African Americans' cultural beliefs about depression may have affected their subjective reports of how they responded to the questionnaire. It could be that they responded inaccurately to the items. For instance, individuals of African American ancestry may view depression as a personal weakness or a stigma of having a character flaw, such as lack of faith (Jang et al., 2005; Mills, Alea, & Cheong, 2004).

This also suggests that religiosity plays a crucial role among OAAs in dealing with life's

trials as it may provide them with psychological resilience (Jang et al., 2005). Third,

OAAs may be less knowledgeable or have more misconceptions about depression, which

may have affected their ability to answer the questionnaire. They also view depression as

a part of life rather than an illness (Mills, Alea, & Cheong, 2004; Mills & Edwards, 2002;

Zylstra & Steitz, 1999). Fourth, a mistrust by OAAs of health care professionals may

have influenced their responses. This population might have experienced racial (Jang et

al., 2005) or medical discrimination, which affects how they respond to each item; racial

discrimination may have increased their tolerance for psychological distress (Mills, Alea,

& Cheong, 2004; Sussman, Robins, & Earls, 1987). Fifth, African Americans appear to

be more resourceful in dealing with depression in later life. They use cognitive and

control-oriented strategies, such as information seeking, home modification or cognitive

reframing, and receive support from family and friends (Gitlin, Hauck, Dennis, & Schulz,

2007; Zylstra & Steitz, 1999). Sixth, they might be a member or have participated in the

Black church (e.g., clergy visit) which is widely documented in the literature to have a

significant impact in the lives of African Americans (Blank, Mahmood, Fox, &

Guterbock, 2002; Mills, Alea, & Cheong, 2004) as it provides the necessary social

services. Social services increase their psychological resilience and enhance their coping

abilities. Finally, it might be that the older participants included in the study have

depression scores within the normal range.

Findings in Relation to Functional Activity

　　　　One of the key findings of this study is the highly statistically significant

relationship between functional activity and level of cognition. This result is consistent in

the previous literature. For instance, Mayo et al. (2012) examined the association

between functional status and judgment or problem-solving among older adults using the

NACC Uniform Data Set. They found that functional status or the performance of IADLs

is a predictor of older adults' judgment or problem-solving ability. Masters, Morris, and

Roe (2015) observed the decline of noncognitive symptoms among cognitively normal

participants who progressed to Clinical Dementia Rating (CDR) > 0 as well as those who

remained CDR = 0. Participants with CDR=0 has normal cognition, while 0.5=very mild,

1=mild, 2= moderate, and 3=severe dementia. Results of their study revealed that

participants who progressed to CDR > 0 have a significantly greater decline in functional

activities (i.e., IADL) compared to those who did not progress (CDR=0). In another

study, Teng et al. (2010) examined the performance of the FAQ in measuring older

adults' IADL performance to differentiate MCI from very mild AD using the data from

NACC Uniform Data Set. Teng et al. (2010) found that older adults with AD have

significantly greater functional impairment compared to older adults with MCI.

Additional support from the literature was found for playing games and paying

bills. Playing games predict the level of cognition among older adults. Older adults who

engage in playing games have higher MMSE scores or better cognitive level and that

playing games help delay cognitive decline. Mortenson, Sixsmith, and Kaufman (2017)

conducted a study on non-digital games among older adults. They categorized the types

of games played, explored the perceived benefits of non-digital game, and identified

sociodemographic factors that predict these benefits of playing non-digital games. They

found that card games are the most commonly played games, followed by board games

(e.g., scrabble, chess), puzzles (e.g., crossword), gambling (e.g., bingo, poker), tile or

tabletop games and sports or physical games. Results showed that the most perceived

benefit of playing non-digital game is enjoyment (83.2%), followed by mental

stimulation (77.9%), social interaction (70.6%) and escape from life (26%). Gender is

also identified as a significant predictor for the four perceived benefits of playing non-

digital game. For instance, men have lower odds ratio to report mental stimulation as a

perceived benefit of playing non-digital game than women. For social interaction, men

are less likely to play with social interaction as a perceived benefit than women.

Similarly, a lower odds ratio has been found for men playing non-digital game for

enjoyment than women. The same result is noted for playing non-digital game as a means

of escape from life. Men reported less odds ratio on playing non-digital game as a escape

from daily life than women. This study shows that playing games has enormous benefits

among older adults, especially in their cognitive and social aspect. Thus, they need to be

encouraged to participate and engage in activities that involve playing non-digital games

to enhance mental stimulation and delay cognitive decline.

Further, in a study that examined the relationship between playing board games

and risk of dementia, Dartigues et al. (2013) found a 15% lower risk of dementia for

those who play board games compared to non-players. In their study, board games

include card games, bingo, chess, and other parlour games. Also, those who play board

games reported less cognitive decline, as shown in their MMSE scores, and less

depression compared to non-players. This suggests that playing games is not only a form

of leisure activity, but also provide mental stimulation to the older participants. Playing

board games has multi-purpose, but most of all, it offers a protective factor against

cognitive decline among older participants aside from the enjoyment and interaction they get from playing.

Litwin, Schwartz, and Damri (2017) communicated similar results in their study whether cognitively stimulating leisure activity, such as word or number games (e.g., crossword puzzles or Sudoku), can either delay or reduce cognitive decline. They found that frequently engaging in cognitively stimulating leisure activity is positively related to cognitive function measures (i.e., memory, numeracy, and fluency). This indicates that those who engage in cognitively stimulating leisure activity almost everyday have higher cognitive function than those who infrequently or never participated in such activities. Similar result was reported from the work of Ferreira, Owen, Mohan, Corbett, and Ballard (2014) who conducted a study to examine the relationship between cognition and cognitively stimulating leisure activities, such as cross word and Sudoku puzzles. Results of their study showed that frequently engaging in cognitively stimulating leisure activities was positively related to level of cognition (i.e., grammatical reasoning, spatial working memory, and episodic memory).

Literature also supports the relationship of level of functional activity and level of cognition on the ability to pay bills. Results suggests that those who are dependent in paying bills have lower level of cognition, which is evident in AD. AD encompasses a loss in the ability to perform higher order or complicated tasks, such as the IADLs (Marson et al., 2000; Marson et al., 2009). While older adults suffer from AD experienced various impairment, their ability to pay bills or financial ability is greatly affected. This is consistent with prior studies that show older adults with mild AD have impairment in managing their finances.

Financial capacity is vital to function independently. It is highly sensitive across the continuum of AD (e.g., mild and moderate AD), thus, it is valuable to understanding functional decline in AD. It includes several domains, such as basic monetary skills (e.g., counting coins), financial conceptual knowledge (e.g., defining financial concepts), cash transactions (e.g., purchasing 1-item grocery), checkbook management (e.g., using checkbook), bank statement management (e.g., using bank statement), and financial judgment (making investment decision) (Marson et al., 2000). Marson and colleagues (2000) communicated that varying degree of financial capacity difficulty was observed among participants with mild AD while a global loss was reported to those at the moderate stage of the disease. For instance, those who have mild AD retain the simple financial abilities (e.g., counting coins and purchasing 1-item grocery) while those with moderate AD appear to completely loss both simple and complex abilities (e.g., using a checkbook and bank statement) (Marson et al., 2000). Further, Martin et al. (2008) investigated the change over time in the financial abilities of older adults with mild AD. They found that older adults with mild AD have already substantial impairment in financial abilities at baseline and experienced further rapid decline after one year compared to the healthy controls. Educating the older adults and their families on the loss of financial abilities due to AD at the earlier stage of the disease can help protect their economic resources, make early financial arrangements and informed decisions, explore possible alternative options, and enhance their well-being.

Implications

Results from the present study have implications to the co-participant, family, health care providers, policy-makers, and researchers in the area of aging.

Co-participants and Family Members

Findings from this study show that the frequency of calls older adults received

from their co-participants, who can be family members or friends, predict their level of

cognition. Specifically, more frequent calls received indicates higher cognition or MMSE

scores. The result should be shared to the co-participants or family members so they can

include giving a phone call to a family member who is living with AD a priority. By

doing this, they can help delay the cognitive decline experienced by the older adult. The

co-participant or family members should not only be educated with the decline in the

level of cognition, but also with functional activity. In this study, functional activity

refers to the performance of IADLs, such as 1) ability to pay bills, 2) completing tax or

business records, 3) shopping, 4) playing games, 5) making coffee, 6) preparing balanced

meals, 7) tracking current events, 8) attending to TV programs, books, and magazines, 9)

remembering appointments, family occasions, and managing medications, and 10)

traveling outside the neighborhood (Brown et al., 2013, p. 677; Teng et al., 2010, p. 350).

These IADLs are complicated tasks that are valuable to living an independent life.

Impairment in any of these activities is a burden not only to the older adult, but also to

the family. Health care professionals should assist the co-participants or family members

in understanding the functional impairment an older adult will undergo as the disease

progresses. This will help them explore alternative options in dealing with the

impairment and assist the older adults and families in making informed decisions.

Health Care Providers

The health care providers are in the best position to inform and educate older

adults' co-participants and family members regarding the meaningful contribution of

social support (i.e., frequency of calls) in delaying cognitive decline. Providing social

support in any form, especially in the form of telephone calls, should be emphasized.

They should also provide education on the functional impairment an older adult will

experience in AD. Health care providers should understand that this is a hard time for

both the co-participant and family members, and should patiently explore options with

the family members and older adult to make plans in times when older adults' functional

abilities become completely impaired. Informing them at the earlier stage of the disease,

if possible, seems to be the best move towards making plans on the possible functional

impairment since an older adult can still make sound judgment. Health care providers

should help facilitate in making informed decisions.

Policy-making

        Findings of this study provide direction for policy-makers on developing an

inventory of programs that encourage and facilitate various forms of social support from

the individual, family, and community to elderly living with AD. Advocacy Day at the

Capitol is one of the avenues that this could be done. They should be informed on the

psychosocial factors, such as social support, that can help prevent or delay cognitive

decline, especially at the earlier stage of the disease. Policy-makers can serve as health

advocate by making and implementing policies related to AD and older adults'

caregivers. For instance, facility-wide policies that would utilize psychosocial factors

(i.e., social support) to enhance social ties would be beneficial for the older adults

because they contribute to delaying cognitive decline. This, as a whole, has an impact in

the health care of the country as it will possibly minimize health care cost on AD.

More specifically, administrators in the congregate residential settings could be informed and educated on the benefits of social support, particularly frequency of calls, to the level of cognition among older adults. As administrators, they can create and influence policies in their facilities. For instance, a policy can be made that strongly encourages family members to make telephone contact to older adults with AD at least once a week. Benefits of telephone contact to the level of cognition should be emphasized to maintain adherence. Frequency of telephone contact is a form of social support that helps delay cognitive decline among older adults.

Nursing Research

Although results from this study revealed that social support (i.e., frequency of calls) significantly predicted level of cognition, it did not specifically determine the type of support as well as the satisfaction of support older adults received. Researchers in the area of aging should further investigate the impact of social support, including its type and level of satisfaction, to specifically determine the type of intervention needed.

Future research should also be conducted on the relationship of level of functional activity and level of cognition. These studies should focus on the individual items of functional activity and determine which is greatly affected as AD progresses. Results from these studies would help identify specific interventions for each functional activity.

This is also a cross-sectional study. Thus, future research should use longitudinal research design to strengthen the positive associations between extent of social support and level of cognition, and level of functional activity and level of cognition, as well as enhance the generalizability of the findings to the African American older population. Future longitudinal studies could also help examine the trend on the relationship between

extent of social support and level of cognition, and level of functional activity and level of cognition, over time.

Further, culturally-tailored interventions that would help delay or prevent cognitive decline and functional impairment among older adults living with AD should be implemented. For instance, interventions that utilize information and communication technology, such as phones and computers (e.g., tablets), should be considered in the future researches. Research in these areas are important to informing practice and improving the well-being of the older adults living with AD.

Limitations and Recommendations

First, the study has a small sample size (n=56). The sample also has varying degree of missing data, which could lead to bias interpretation of results. It would be helpful if a future study has a larger sample size to capture more significant differences among the study variables and strengthen the significant association between extent of social support and level of cognition, and level of functional activity and level of cognition. With regards to handling missing data, future studies should continue to use state of the art techniques in dealing missing data, such as various multiple imputation techniques.

Second, the study is a cross-sectional design. It only allows to measure the association among study variables at a single point in time. Future studies should use longitudinal research design to identify trends and compare patterns at each year. This is helpful to track changes in the level of cognition and level of functional activity among the older adults over time.

Third, the study only included data from a single year (i.e., 2013). Further

investigation should be conducted including other years of the NACC Uniform Data Set

(i.e., 2005-2017). Analyses from these years will obtain a large sample size and allows

the use of reputable longitudinal data.

Fourth, the Montreal Cognitive Assessment (MoCA) test, a reliable and sensitive

measure of cognition, was not used in this study to assess the level of cognition because it

was only available in version 3 of the NACC Uniform Data Set. The data collection for

the version 3 of the Uniform Data Set has not started until 2015. Thus, data from the

MoCA was not yet available on 2013. Future research should include the use of MoCA

and compare its results, if possible, with the MMSE.

Fifth, multiple regression results for the relationship between level of functional

activity and level of cognition have not specifically identified which IADLs were greatly

affected as AD progresses. Identification of the specific functional activity is crucial to

planning as well as implementing culturally-tailored interventions.

Sixth, although results of the study showed an association between frequency of

calls and level of cognition and level of functional activity and level of cognition, it does

not establish any causation. Future research should include robust experimental designs

or culturally-tailored interventions that will support the associations and establish

causality among the study variables.

Seventh, although it was short and easy to administer, there are several limitations

for the social support measure used in this study. First, since it is a single-item measure, it

was unable to measure and evaluate other aspects of social support. It only measured one

of the structural aspects of social support, which were the frequency of calls and visits

older adults received from their social network. Second, the correlations for the two

measures differ, one has a negative sign (i.e., frequency of visits) while the other has a

positive sign (i.e., frequency of calls), which affect their ability to be combined as one

measure of social support (i.e., total social support). Third, since frequency of visits and

frequency of calls are not correlated, their reliability coefficient appears to be very low or

cannot be estimated (Wanous, Reichers, & Hudy, 1997). Fourth, both frequency of visits

and calls have missing data (i.e., n=8, respectively). Fifth, regression results showed

different results between frequency of visits and calls. For instance, the relationship

between frequency of visits and level of cognition were not significant, but the

relationship between frequency of calls and level of cognition were significant. In this

light, future studies should use other reliable and valid measures of social support, such

as the Social Provisions Scale, Sense of Support Scale, Family Support Scale, and Social

Support Questionnaire to evaluate other aspects of social support.

Finally, although the Geriatric Depression Scale is a valid and reliable screening

measure for depression (Almeida & Almeida, 1999), it should be used with caution

among older adults with cognitive impairment. For instance, those who are more

cognitively impaired have more difficulty responding to each item. Also, the Geriatric

Depression Scale is a good screening tool for mildly demented subjects, but not for

moderately to severely demented subjects (Holroyd & Clayton, 2000). In this study, most

of the participants belong to the range of moderate cognitive impairment. Thus,

researchers should carefully interpret the results taking into consideration the older

adults' level of cognition as well as cultural beliefs.

In sum, future studies relating to this research should have the following characteristics: 1) consists of a larger sample size to obtain a large effect size; 2) uses a longitudinal research design, including other years in the NACC Uniform Data Set, to be able to compare trends and patterns between years of NACC visits; 3)) uses other measure of cognition, such as the Montreal Cognitive Assessment (MoCA) test, a more sensitive measure of cognition to cognitively impaired population; 4) incorporates culturally-tailored interventions to be able to establish causality; 5) includes other characteristics of the co-participants to know them better and evaluate what other characteristics influence older adults' level of cognition; 6) identifies the type of social support and the level of satisfaction older adults received from their social network, and uses more reliable and valid measures to evaluate other aspects of social support; 7) identifies which of the IADLs or individual items in the Functional Activities Questionnaire are greatly affected as older adults become more cognitively impaired to devise a more specific intervention; and if possible, 8) includes the different classification of AD to identify specific needs at each stage of the disease.

Conclusion

Older African Americans (OAAs) are the population most hit by Alzheimer's disease (AD), which is the fifth leading cause of death for the older adults in the United States (Alzheimer's Association, 2014, 2015). The burden of AD on the individual, family, community, and health care systems demands attention and efforts to prevent or at least delay the cognitive decline among older adults should be prioritized.

Although the sample was relatively small, findings suggest that various forms of social support play a protective role in people living with AD. Results of this study

highlight the importance and beneficial effect of social support and functional activity on

the level of cognition among OAAs with AD living in all types of congregate residential

settings. In addition, limitations of this study provide direction for future research to

include variables for better understanding of how the type of support may shape level of

satisfaction and functional activity directly or indirectly, thus, affecting level of

cognition. The non-significant result between depression and cognition should be

carefully interpreted taking into consideration the cultural variation in beliefs and self-

expression of negative moods, such as depression in ethnic minorities, including OAAs.

Finally, the study further suggests that psychosocial factor, such as social support, can be

integrated in the care of older adults with AD living in the congregate residential settings.

Therefore, activities that could promote social support in the congregate residential

settings should be given importance. Culturally-tailored interventions should be used for

future research to strengthen association and establish causality between the extent of

social support and level of cognition.

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