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Social Engagement, Cognition, Depression and Co-morbidity in Sensory Impaired Nursing Home Residents

Darina V. Petrovsky, PhD, RN [Postdoctoral Research Fellow],
Ruth L. Kirschtein National Research Service Award (F32AG060630), University of Pennsylvania School of Nursing, Fagin Hall, 418 Curie Blvd., Philadelphia, Pennsylvania, USA 19104-4217

Justine S. Sefcik, PhD, RN [Postdoctoral Research Fellow],
NewCourtland Center for Transitions and Health (T32NR009356), University of Pennsylvania School of Nursing, 3615 Chestnut St., Philadelphia, Pennsylvania, USA 19103

Alexandra L. Hanlon, PhD [Practice Professor of Biostatistics],
Virginia Tech, One Riverside Circle, Suite 104, Roanoke, Virginia, USA 24016

Alicia J. Lozano, MS [Research Associate],
Virginia Tech, One Riverside Circle, Roanoke, Virginia, USA 24016

Pamela Z. Cacchione, PhD, CRNP [Ralston House Endowed Term Chair in Gerontological Nursing; Associate Professor of Geropsychiatric Nursing]
University of Pennsylvania School of Nursing, Room 410 Fagin Hall, 418 Curie Blvd., Philadelphia, Pennsylvania, USA 19104-4217, Nurse Scientist, Penn Presbyterian Medical Center, 51 N 39th St, Philadelphia, Pennsylvania, USA 19104

Abstract

Sensory impairment specifically, vision and hearing impairment, among nursing home (NH) residents decreases their ability to socially engage. It is not known, however, to what extent visual, hearing or dual impairment is associated with social engagement. The aims of this retrospective, cross-sectional descriptive study were to determine the relationship between social engagement and a) levels of sensory impairment (vision, hearing and dual); b) depression; and c) cognition. We analyzed baseline data from 213 sensory impaired NH residents from the I-SEE study. Multivariable model results demonstrated that sensory impairment was not associated with social engagement when adjusting for all covariates. Less depression, better cognition and greater co-morbidity were significantly associated with greater social engagement. Clinicians should be aware of these risks to social engagement in sensory impaired NH residents and monitor for decreased social engagement and isolation in residents with less comorbidities, higher depression levels and poorer cognition.

CORRESPONDING AUTHOR: Pamela Z. Cacchione, PhD, CRNP, Ralston House Endowed Term Chair in Gerontological Nursing; Associate Professor of Geropsychiatric Nursing, University of Pennsylvania School of Nursing, Room 410 Fagin Hall, 418 Curie Blvd., Philadelphia, Pennsylvania, USA 19104-4217, Nurse Scientist, Penn Presbyterian Medical Center, 51 N 39th St, Philadelphia, Pennsylvania, USA 19104, Tel: (215) 746-5472, fax: (215) 746-0570, pamelaca@nursing.upenn.edu.

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Keywords

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INTRODUCTION

There are greater than 15,000 nursing homes (NH) in the United States with more than 1.4 million residents (US Department of Health and Human Services, 2015). Hearing and vision loss in NH residents are often overlooked and not sufficiently assessed (McCreedy, Weinstein, Chodosh, & Blustein, 2018). There are numerous adverse effects associated with sensory loss including communication problems (Yamada et al., 2014), decreased cognitive function (Jupiter, 2012), depression, functional decline and falls (Li et al., 2011) as well as a higher incidence of behavioral symptoms (Yamada et al., 2015). Dual impairment is associated with increased morbidity and mortality (Gopinath et al., 2013). Additionally, sensory impairment may contribute to social isolation among NH residents which can negatively affect their quality of life (Resnick, Fries, & Verbrugge, 1997).

Social engagement among NH residents has been associated with cognition, co-morbidity and depression. Previous research consistently reported that greater cognition was associated with greater social engagement in NH residents (Guthrie et al., 2018). Greater co-morbidity was associated with greater engagement in NH residents with dementia (Cohen-Mansfield, Marx, Regier, & Dakheel-Ali, 2009). Studies exploring the association between social engagement and depression reported mixed results. Previous studies reported a negative association (lower depression associated with higher social engagement) (Achterberg et al., 2003; Kang, 2012); whereas, van Beek and colleagues found no relationship between depressive symptoms and social engagement in 502 NH older adults once they accounted for resident characteristics (van Beek, Frijters, Wagner, Groenewegen, & Ribbe, 2011). Further research is needed to better understand social engagement among NH residents, including a specific focus on those residents with sensory impairment.

Vision Impairment

Normal 20/20 vision diminishes with aging and visual impairment is common among older adults living in NHs (Owsley et al., 2007). Studies in NHs have revealed that 37% (Friedman, West, Munoz, & et al., 2004) to 70% (Elliott, McGwin, & Owsley, 2013) of older adults in NHs or assisted living have visual acuity worse than 20/40 in the better-seeing eye. Mild visual impairment is considered between 20/25 and 20/50, moderate impairment 20/60 to 20/160, legally blind 20/200 to 20/400 and profound vision impairment is considered 20/400 to 20/1000 (Agency for Healthcare Research and Quality, 2004). The most common causes for blindness or vision impairment in NH residents include cataracts, pathologic myopia, and age-related macular degeneration (Sainz-Gómez et al., 2010). Visual impairment in NH residents is associated with decreased health-related quality of life (Dev, Paudel, Joshi, Shah, & Subba, 2014) and cognitive impairment (Mitchell, Hayes, & Wang, 1997).

Hearing Impairment

The American Speech-Language-Hearing Association defines hearing loss by decibel levels: normal (10– 25 dB), slight (16 - 25 dB), mild (26-40 dB) moderate (41 - 55 dB), moderately severe (56-70), severe (71 - 90 dB) and profound hearing loss (≥ 91 dB) (Clark, 1981). The prevalence of hearing impairment in NH residents varies between 54% and 90% (Bagai, Thavendiranathan, & Detsky, 2006; Cacchione, Culp, Dyck, & Laing, 2003). Most frequent types of age associated hearing impairment are sensorineural and conductive (Huang & Tang, 2010). Hearing impairment in NH residents is associated with higher rates of limited communication, fatigue, and balance problems (Yamada et al., 2014), decreased cognitive function (Jupiter, 2012), decreased quality of life and lower overall well-being (Cacchione, 2012; Resnick et al., 1997).

Dual Impairment

Dual impairment includes older adults with both visual and hearing impairments. Prevalence of dual sensory impairment in NH residents varies between 9.7% and 33.9% (Cacchione et al., 2003; Guthrie, Declercq, Finne-Soveri, Fries, & Hirdes, 2016; Yamada et al., 2014). Residents with dual impairment are likely to experience cognitive impairment, functional disability, communication difficulties and be diagnosed with dementia of Alzheimer's type (Guthrie et al., 2016). Furthermore, dual impairment in NH residents is associated with a higher incidence of behavioral symptoms (Yamada et al., 2015), and a greater risk for clinical issues, such as communication problems, fatigue, balance problems, and sleep disruptions compared to NH residents with a single impairment (Yamada et al., 2014).

Social Engagement

Social engagement has been defined as the "degree of participation in a social setting and the ability to initiate and to be receptive to social interactions" (Dupuis-Blanchard, Neufeld, & Strang, 2009, p. 1187). The presence of social interactions has been linked to positive health benefits, including psychological well-being (Yeung, Kwok, & Chung, 2013) and reduced loneliness (Drageset, Kirkevold, & Espehaug, 2011). Conversely, the lack of social engagement is detrimental to the health of NH residents. For instance, in a study of 30,070 NH residents, residents with higher levels of social engagement had longer 1-year survival rates compared to residents with lower levels of social engagement (Kiely & Flacker, 2003). Social engagement is an important aspect of NH residents' lives and predicts mortality in this highly vulnerable population.

Sensory Impairment and Social Engagement of NH residents

Single or dual sensory impairment may limit social engagement in NH residents. In past studies, vision impairment has been associated with decreased social engagement in NH residents with dementia (Kang, 2012). One study of 2,851 older adults in NHs found those not involved in everyday activities had 51% higher mortality compared to those who engaged in everyday activities (Yamada et al., 2016). Previous NH studies examining the relationship between sensory impairment and social engagement relied on subjective measures of sensory impairment without an objective clinical assessment of sensory impairment. In addition, less is known about the relationship between social engagement and

co-morbidity in sensory-impaired NH residents. Therefore, the purpose of this study was to examine the associations between social engagement and the different levels of sensory impairments, depression and cognition in NH residents. The research questions were the following: controlling for co-morbidity, what is the relationship between social engagement and a) levels of sensory impairment in vision and hearing (individually and combined); b) depression; and c) cognition in sensory impaired NH residents?

METHODS

This descriptive study is a secondary analysis of baseline data from an intervention study [R01 N008777] Nursing Interventions for Sensory Impaired LTC Elders (referred to as the parent study). The parent study was a randomized prospective clinical trial with a two-group design (an Individualized-Sensory Enhancement for the Elderly, I-SEE, intervention group and an Attention Control, AC, group) to test the efficacy of the I-SEE intervention to improve hearing and vision, cognitive performance, depression, and social engagement in addition to other health outcomes pertaining to older adults residing in NHs, described elsewhere (Cacchione, Willoughby, Langan, & Culp, 2011). The I-SEE group received individualized care planning for older adults based on the nursing assessments of the NH residents' sensory status, followed by individualized nursing interventions and referrals to interprofessional colleagues to improve or enhance an older adult vision and hearing, delivered three times a week. The AC group received a 15-minute social visit and both groups were screened for delirium three times a week.

Screening and Enrollment Procedure

The parent study enrolled older adults from seven nursing homes in the Midwest, United States. Participants were randomly selected based on a random numbers table and the resident's room and bed number. The older adults were consented, and then screened for eligibility. Inclusion criteria were: 1) Age 65 or older; 2) no more than moderate cognitive impairment as measured by a Blessed Orientation and Concentration Test score of less than 26, (scores range from 0 to 28; it is reverse scored with higher scores indicating worse cognitive impairment, score of 26 indicates advanced cognitive impairment), 3) Best corrected distance vision of 20/50 or worse on the Early Treatment of Diabetic Retinopathy Study Eye chart (ETDRS) (Ferris III, Kassoff, Bresnick, & Bailey, 1982) and/or failure to hear the test tone at 40 dBL, 1000 Hz on the Madsen Portable Audiometer. Exclusion criteria were: 1) aphasia, 2) scoring as delirious on the NEECHAM Confusion Scale, 3) inability to hear the test tone at 80 dBL both ears, or no light perception in both eyes.

The consent process entailed reviewing the consent form with each participant followed by four questions: "What is the purpose of the study; what are the risks; what are the benefits; and how do you contact the investigator". If the potential participant was able to answer 3 out of the 4 questions correct, they were deemed able to provide their own consent. If they could not answer 3 out of 4 questions but still wanted to participate, consent was obtained from their responsible party listed in the chart. A total of 526 participants consented or assented to participate. Of those, 225 met the inclusion criteria and were enrolled in the parent study. These secondary analyses reflect 213 of the 225 enrolled participants (11 were

dropped due meeting inclusion criteria at the screening visit but then scoring within the normal range of sensory impairment on baseline assessments, and 1 due to missing data for scores used to identify sensory impairment). Their baseline assessments were used for this study. The parent study received the Institutional Review Board approval from the Saint Louis University and the University of Pennsylvania. The baseline visits entailed two one-hour visits to complete evaluations of vision and hearing, cognition, depression, delirium, social engagement, co-morbidity, and physical performance.

Measures

All of the measures were completed by the research nurses who were trained as a group at the beginning of the study until inter-rater reliability reached at least 90% on all measures. Inter-rater reliability checks were completed at the start of each baseline assessment in each nursing home by assessing three participants as a group with remedial training provided if needed. Vision was assessed using the Early Treatment of Diabetic Retinopathy Study (ETDRS, National Eye Institute Ferris-Bailey Chart) (Pelli & Robson, 1988) originally developed for the early detection of diabetic retinopathy (Pelli & Robson, 1988). NH residents were considered to be visually impaired if their best corrected visual acuity was worse than 20/50 on the ETDRS in both eyes.

Hearing impairment was measured with the Madson 304 portable audiometer at the 40 dBL 1000 Hz level, calibrated to the standards of the American National Standards Institute (American National Standards Institute, 1989). Participants were designated as hearing impaired if they could not hear the test tone at 40 dBL and 100-Hz in both ears. Further testing was carried out at 20, 25, 40, 60, 70 and 80 dBL with standard frequencies of 500, 1000, 2000, and 4000 Hz to calculate a pure tone average.

In order to better describe the level of impairment in each sense, we categorized vision impairments as mild (best ETDRS in both eyes 33-35 letters); moderate (best ETDRS in both eyes 8-32 letters); and legally blind (best ETDRS in both eyes ≤ 7 letters). We categorized participants' hearing impairment based on average PTA levels in best ear as: moderate (41-55 dBL), moderately severe (56-70 dBL) and severe (greater than 71 dBLs), consistent with the American Speech-Language-Hearing Association (Clark, 1981). To describe levels of dual impairment, we created 9 new categories: 1) mild vision – moderate hearing; 2) mild vision – moderately severe hearing; 3) mild vision – severe hearing; 4) moderate vision – moderate hearing; 5) moderate vision – moderately severe hearing; 6) moderate vision – severe hearing; 7) legally blind – moderate hearing; 8) legally blind – moderately severe hearing; and 9) legally blind – severe hearing.

Social Engagement was measured using the Brief Assessment of Social Engagement (BASE), a 20-item scale from the Nottingham Longitudinal Study of Activity and Aging (NLSAA) (Morgan, 1998). This self-report scale measures twenty positive social engagement activities including: telephone calls; attending religious services; voting; taking a holiday; use of public library; access to a car, attendance at group meetings; contacts with family and friends; employment; newspaper, magazine, radio and television use. In addition, the BASE identifies if the person ambulates, shares a room, gets out and about, and the presence of frequent loneliness. Each item is answered with 1 or 0 ("yes" or "no"). Items are

added to give a summative continuous score (out of 20) reflective of older adults' participation in activities (Morgan, 1998). Higher scores indicate higher social engagement and the capacity to initiate social interaction. The scale has a high alpha coefficient of 0.7 (Morgan, 1998). Test-retest reliability was established in the NLSAA study (Morgan, 1998). This scale has been determined to be a valid measure for social engagement in NH elders (Resnick et al., 1997).

Depression was measured using the Geriatric Depression Scale (GDS) originally developed to assess depressive symptoms in community dwelling older adults (Yesavage et al., 1982). The measure consists of 30 yes/no items measuring symptoms of depression during the two weeks prior to the interview. The scale was reported to have high internal consistency, Cronbach's alpha coefficient of 0.94, high test-retest reliability (0.85) and high correlation with other depression measures that establishes its validity. Higher scores correlate with higher levels of depression in older adults (Yesavage et al., 1982).

Cognition was measured using the Mini Mental Status Examination (MMSE), a 30-item scale that measures orientation, registration, attention, calculation, recall and language in older adults (Folstein, Folstein, & McHugh, 1975). The maximum score is 30 with lower scores indicating greater severity of cognitive impairment. The MMSE has a sensitivity of 0.87 and specificity of 0.82 for detecting cognitive impairment (Folstein et al., 1975).

Co-morbidity was measured using the Cumulative Illness Rating Scale (CIRS) (Linn, Linn, & Gurel, 1968), which rates all thirteen body systems on a scale from "1" (no impairment) to "5" (life-threatening impairment) without the use of specific diagnoses. Range of possible scores were 0 to 70 with higher numbers indicating greater co-morbidity (Linn et al., 1968). The CIRS includes an item on eye and ear problems. These items were included in the CIRS total score. This CIRS was then used as a covariate and was initially proposed as a way to distinguish biologic from chronologic aging. This scale has been validated for use in NH settings (Parmelee, Thuras, Katz, & Lawton, 1995) and is superior to the Charlson Co-morbidity index in complex older adult populations (Rochon et al., 1996). The CIRS was collected via chart review by the PI, a nurse scientist and a Gerontological Nurse Practitioner.

Analysis

Preliminary analyses included generating descriptive statistics for all baseline measures to characterize the sample. All continuous variables were normally distributed and were described using means and standard deviations. Dichotomous and categorical variables were described with frequencies and percentages. A one-way analysis of variance (ANOVA) test examined the differences in social engagement across the sensory impairment groups.

General linear modeling assessed the effects of sensory impairment, cognition, and depression on social engagement. Initially, we generated simple general linear models for each independent predictor, followed by a full model regressing social engagement on all three predictors, while adjusting for co-morbidity. We generated a final multivariable model for social engagement using backwards selection methods, where predictors were removed one at a time until all those remaining in the model were significant at the 0.05 level.

Statistical significance was taken at the 0.05 level. All analyses were conducted in SAS Version 9.4 (SAS Institute Inc., Cary, NC).

RESULTS

Two hundred and thirteen participants were included in the analysis. Participants were mostly female (n=158, 74.2%), white (n= 196, 92.0%) with a mean age of 86.38 (SD 7.32) years. All participants were either hearing (n=103, 48.4%), visually (n=29, 13.6%), or dually impaired (n=81, 38%) with a mean MMSE score of 22.70 (SD 4.81), consistent with mild cognitive impairment. The mean GDS score was 8.58 (SD 5.72), corresponding to a negative depression screen. The mean CIRS score was 28.66 (SD 3.99). The most common participants' diagnoses were: hypertension, arthritis, dementia, depression, gastric esophageal reflux disease, coronary artery disease and diabetes. Descriptive statistics for this sample are summarized in Table 1. On average, participants reported a mean BASE score of 12.08 out of 20 possible points (SD 3.04). A one-way ANOVA test demonstrated that social engagement did vary by sensory impairment group. Specifically, hearing (Mean 12.50, SD 2.62) and visually (Mean 12.45, SD 2.82) impaired residents were statistically significantly more socially engaged than dually (Mean 11.42, SD 3.51) impaired residents (p=0.046, Table 2).

Simple general linear models that adjusted for co-morbidity (CIRS) demonstrated that depression (p<0.0001), and cognition (p=0.031) were independently associated with social engagement (Table 3, Models 2 & 3, respectively). For each unit increase in the depression scale (GDS), there was a 0.16 decrease in social engagement, adjusting for co-morbidity. Additionally, there was a 0.09 increase in social engagement for each unit increase in cognition (MMSE), adjusting for co-morbidity. Overall, sensory impairment was not independently associated with social engagement (p=0.069) when adjusted for co-morbidity, although we still found significant differences in social engagement between hearing and dually impaired residents (p=0.027; Table 3, Model 1). In the full model, sensory impairment remained non-significant (p=0.277; Table 3, Model 4).

Since we found no association between sensory impairment and social engagement but did find significant relationships between depression and cognition, we created a final multivariable model consisting only of significant predictors of social engagement. Using a backwards elimination method, depression (p<0.0001), cognition (p=0.008), and co-morbidity (p=0.024) remained significant predictors of social engagement (Table 4). For each unit increase in depression, there was a 0.17 decrease in social engagement. There is a 0.11 increase in social engagement for each unit increase in cognition. Additionally, for each unit increase in co-morbidity, there is a 0.11 increase in social engagement.

DISCUSSION

The purpose of this study was to examine the associations between social engagement and the different types of sensory impairments, depression and cognition in sensory impaired NH residents. Surprisingly, this study showed that social engagement in sensory impaired NH residents was not associated with sensory impairment. Our study did, however, find that

less depression, better cognition, and greater co-morbidity were associated with greater social engagement. Our results indicate that factors, such as depression, cognition and co-morbidity were stronger predictors of social engagement in NH residents compared to sensory impairment.

Our findings are in contrast with previous research that found an association between social engagement and vision impairment in NH residents with dementia (Kang, 2012). Kang and colleagues enrolled NH residents with severe cognitive impairment compared to our sample that included residents with intact to moderate cognitive impairment (Kang, 2012). In addition, the lack of an association between sensory impairment and social engagement in our study may be due to the limited variation in social engagement scores by type of sensory impairment. To further examine the associations between social engagement and sensory impairment, we ran additional analyses using the actual sensory impairment scores. Hearing impairment was defined as number of letters on the ETDRS. The degree of visual impairment was measured using the average PTA in best ear. In addition, we also analyzed the standardized score of the ETDRS and PTA (created first by standardizing each score and then taking the sum), but the conclusions did not differ (Supplementary Table 1).

Our significant associations between residents' social engagement, cognition, co-morbidity status and depression are consistent with previous findings. NH residents with increased levels of cognitive impairment were less likely to be socially engaged, compared to NH residents with less cognitive impairment (Achterberg et al., 2003; Guthrie et al., 2018). Cognitive impairment may limit their ability to engage in activities, such as talking on telephone, attending religious services, or voting, as these activities rely on short-term memory. Similar to previous research in NH residents (Cohen-Mansfield, Dakheel-Ali, & Marx, 2009), we found that greater co-morbidity was associated with greater social engagement in sensory impaired NH residents. The previous study hypothesized this was due to NH residents who experience increased burden from co-morbid conditions may have intact cognition. Therefore, they may rely on their cognition more than their senses when participating in social activities (Cohen-Mansfield, Dakheel-Ali, et al., 2009). We confirmed this hypothesis by examining the relationship between co-morbidity and cognition and found that in this sample more comorbidities were significantly associated with better cognition ($p=0.005$; Supplementary Table 2). When examining an association between depression and social engagement, we found that higher levels of depression were associated with lower levels of social engagement. Our findings were consistent with previous research examining social engagement in Dutch NH residents (Achterberg et al., 2003), NH residents with dementia (Kang, 2012), and long-term care facility residents in Hong-Kong (Lou, Chi, Kwan, & Leung, 2013). NH residents who feel sad or depressed may not engage or may withdraw from group activities.

Our study has limitations. First, the BASE instrument did not assess the frequency the NH residents participated in social activities. In addition, some of the BASE questions might not apply to NH residents. For example, questions asking older adults about taking a holiday, using public library, access to a car may not be applicable to NH residents. In addition, although meant to be brief, the length of twenty questions might be too long for NH residents. Second, we did not assess for other confounders such as pain. Even though this

secondary analysis had limitations, the strengths of the present study include: the use of objective well-defined sensory assessments and the use of a co-morbidity scale that gauges impairment in body systems, rather than the number of diagnoses.

Although this present study explored social engagement in a rather large sample of NH residents, the findings should be replicated in larger and more ethnically diverse samples of NH residents. This study should also be replicated comparing samples of sensory impaired NH residents with sensory intact NH residents. Future studies should consider both the frequency and the level of social engagement among NH older adults. For instance, using the Social Engagement Index (derived from items on the MDS record), which does not rely on self-report, might be more appropriate for use in NHs to gauge social engagement (Mor et al., 1995). The highly validated 3-item UCLA Loneliness Scale (Hughes, Waite, Hawkley, & Cacioppo, 2004). might also provide more insights into social engagement in this population as well. Alternatively, direct observations of social interactions may be more accurate in capturing social engagement among NHs residents; however, it is the most time-intensive approach (Abbott, Sefcik, & Van Haitsma, 2017). In addition, NHs track attendance at activities; therefore, one could pull attendance of NH residents in activities for a certain time period and take an average weekly attendance. Another approach would be to track visitors to see who has visited specific residents and if there is a pattern to those visits. These approaches track contacts with activities and visitors, but may not identify meaningful social engagement for the individual. A combination or mixed methods approach would provide a greater understanding of the NH residents' meaningful social engagement.

These findings have important implications for clinical care. Clinicians should be aware of these risks to social engagement in sensory impaired NH residents and monitor for decreased social engagement and isolation in residents with less comorbidities, higher depression levels and poorer cognition. The I-SEE intervention to address vision and hearing impairment provides a guide for NH staff to enhance the residents' sensory impairment allowing the staff to coordinate tailored social events to engage residents with sensory impairment to facilitate interactions with others (Cacchione, 2007). This may include one-on-one visits in a quiet space or small group activities, such as an indoor gardening program which has been found to improve life satisfaction, social network, and decrease perceptions of loneliness of NH residents (Tse, 2010). NH staff should proactively invite sensory impaired individuals at risk for decreased social engagement to recreational programs that align with the residents' interest and provide environmental modifications (e.g., decreased environmental noise; enhanced lighting) or use adaptive techniques to enhance participation (e.g., use of planters that highly contrast with the plants; pocket amplifiers). Residents' care plans should include information on person-centered meaningful activities and beneficial environmental modifications to implement to support social engagement activities.

Additionally, care planning for residents with visual impairment should include individualized attention to lighting type and levels, to support residents lighting needs including those residents with sensitivity to light (Cacchione, 2012). Proper care of glasses should be given including: cleaning lenses and engraving names on the frames. For residents with hearing impairment interventions include caring for assistive devices (i.e. name labeling hearing aids or pocket amplifiers), checking if devices are in place, and that

batteries are functional (Wallhagen, Pettengill, & Whiteside, 2006). Environmental modifications include limiting background noise and rearranging furniture to facilitate conversations (Wallhagen et al., 2006).

Since eye conditions and hearing loss are seen more frequently in older adults, providers and nurses should completed routine vision and hearing assessments, including assessing health histories, considering diseases or conditions that negatively impact vision and hearing, and testing distance and near vision, contrast sensitivity, checking ears for cerumen, completing pure-tone audiometry or hand-held audioscope testing, or minimally the finger rub test (Cacchione, 2012; Wallhagen et al., 2006). Attempts should be made to correct deficits with assistive devices and maintain consistent treatment for any pre-existing conditions (e.g., use of eye drops for glaucoma) (Cacchione, 2012).

In summary, our study examined the relationship between social engagement, sensory impairment, depression and cognition in NH residents. We found that residents' depression, cognition and co-morbidity were stronger predictors of social engagement in NH residents compared to sensory impairment. These study findings have implications for healthcare providers, including nurses, involved in assessing sensory impairment and clinical conditions in NH residents. It is important for anyone involved in the care of NH residents to monitor for decline in social engagement and to alert the healthcare team of these changes. Addressing these concerns early may have a lasting positive effect on health and wellbeing of NH residents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Baseline Characteristics of ISEE Participants (N = 213)

Characteristic	**n (%) or *Mean (SD)***
Age in years, *Mean* (*SD*)	86.38 (7.32)
Gender, n (%)	
Female	158 (74.2%)
Male	55 (25.8%)
Race, n (%)	
White	196 (92.0)
Black	16 (7.5)
Other	1 (0.5)
Sensory Impairment, n (%)	
Vision	29 (13.6)
Mild	8 (27.6)
Moderate	14 (48.3)
Legally Blind	7 (24.1)
Hearing	103 (48.4)
Moderate	55 (53.4)
Moderately Severe	41 (39.8)
Severe	7 (6.8)
Dual	81 (38.0)
Mild Vision-Moderate Hearing	9 (11.1)
Mild Vision-Moderately Severe Hearing	5 (6.2)
Mild Vision-Severe Hearing	3 (3.7)
Moderate Vision-Moderate Hearing	30 (37.0)
Moderate Vision-Moderately Severe Hearing	15 (18.5)
Moderate Vision-Severe Hearing	4 (4.9)
Legally Blind-Moderate Hearing	10 (12.4)
Legally Blind-Moderately Severe Hearing	4 (5.0)
Legally Blind-Severe Hearing	1 (1.2)
Visual Acuity (# of letters) – ETDRS, *Mean* (*SD*)	33.64 (15.31)
Hearing (dB) – PTA, *Mean* (*SD*)	52.41 (11.81)
Combined standardized ETDRS and PTA scores, *Mean* (*SD*)	0.04 (1.54)
Co-morbidity – CIRS, *Mean* (*SD*)	28.66 (3.99)
Cognition – MMSE, *Mean* (*SD*)	22.70 (4.81)
Depression – GDS, *Mean* (*SD*)	8.58 (5.72)
Social Engagement – BASE, *Mean* (*SD*)	12.08 (3.04)

SD = standard deviation; ISEE= Individualizes Sensory Enhancement for the Elderly study; ETDRS = Early Treatment Diabetic Retinopathy Study, PTA = Pure Tone Average, CIRS = Cumulative Illness Rating Scale, MMSE = Mini-Mental State Examination, GDS = Geriatric Depression Scale, BASE = Brief Assessment of Social Engagement.

Table 2.

Descriptive Statistics of Social Engagement by Sensory Impairment Group (N = 213)

Sensory Impairment	n	*Mean (SD)*	*P-value*
Vision	29	12.45 (2.82)	0.046
Hearing	103	12.50 (2.62)	
Dual	81	11.42 (3.51)	

SD = standard deviation. P-value based on one-way ANOVA test

Table 3.

General Linear Models of Social Engagement regressed on Type of Sensory Impairment, Depression, and Cognition, Controlling for Co-morbidity (N = 213)

Model	Variable	*Estimate (SE)*	*95% CI*	*P-value*
1	Sensory Impairment			0.069
	Vision	0.96 (0.65)	[−0.31, 2.24]	0.138
	Hearing	0.99 (0.45)	[0.11, 1.87]	0.027
	Dual	REF	REF	
	Co-morbidity – CIRS	0.11 (0.05)	[0.01, 0.22]	0.029
2	Depression – GDS	−0.16 (0.03)	[−0.23, −0.09]	<.0001
	Co-morbidity – CIRS	0.14 (0.05)	[0.04, 0.24]	0.006
3	Cognition – MMSE	0.09 (0.04)	[0.01, 0.18]	0.031
	Co-morbidity – CIRS	0.10 (0.05)	[−0.002, 0.20]	0.054
4	Sensory Impairment			0.277
	Vision	0.74 (0.62)	[−0.47, 1.96]	0.228
	Hearing	0.63 (0.43)	[−0.22, 1.48]	0.148
	Dual	REF	REF	
	Depression – GDS	−0.17 (0.03)	[−0.23, −0.10]	<.0001
	Cognition – MMSE	0.10 (0.04)	[0.01, 0.18]	0.022
	Co-morbidity – CIRS	0.11 (0.05)	[0.01, 0.21]	0.029

*All models are adjusted for co-morbidity as measured by CIRS

REF = reference category; SE = standard error; CI = confidence interval; ETDRS: Early Treatment Diabetic Retinopathy Study; PTA: Pure Tone Average; GDS: Geriatric Depression Scale; MMSE: Mini-Mental Status Examination; CIRS: Cumulative Illness Rating Scale.

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Table 4.

Backwards Selection Multivariable Model for Social Engagement, Adjusting for Co-morbidity (N = 213)

Variable	***Estimate (SE)***	***95% CI***	***P-value***
Depression – GDS	−0.17 (0.03)	[−0.24, −0.10]	<.0001
Cognition – MMSE	0.11 (0.04)	[0.03, 0.19]	0.008
Co-morbidity – CIRS	0.11 (0.05)	[0.02, 0.21]	0.024

SE = standard error; CI = confidence interval; CIRS = Cumulative Illness Rating Scale; MMSE = Mini-Mental State Examination; GDS = Geriatric Depression Scale.