Symptoms of Depression and Social Isolation: The Consequences of Functional Hearing Impairment in Residents of Complex Continuing Care Facilities

Peter Brink

Thesis Supervisor: Michael Stones, Ph.D.

Internal Reader: Charles Netley, Ph.D.

Second Reader: Ron Davis, Ph.D.

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Abstract

Earlier evidence was not conclusive about whether hearing loss is associated with depression and social isolation in elderly residents. The purpose of this study was to determine whether functional hearing impairment (FHI) in residents in complex continuing care facilities is associated with depression and social isolation (anhedonia, reduced social engagement, and reduced activity levels).

Results indicate that functional hearing impairment is associated with symptoms of depression. Residents with FHI have higher levels of anhedonia. Moderate/severe functional hearing impairment is associated with reduced social engagement and low activity level. Path analyses showed that FHI impairs linguistic communication, linguistic communication results in social isolation, and social isolation lowers mood. Results also showed a direct effect of FHI on mood.

This study adds to the literature in support of an association between functional hearing impairment, depression, and social isolation. Although this study is correlational, we propose that functional hearing impairment is associated with depression because of the social isolation caused by poor linguistic communication. While only a hypothesis, pre-existing ailments associated with complex continuing care may also amplify a sense of social isolation.

Introduction

It is not surprising that hearing impairment occurs more frequently among individuals 65 years of age or older (Schow and Nerbonne, 1980). Prevalence rates of hearing impairment range from 31% to 87% among older community dwelling populations and 67% to 100% among older institutional populations (Voeks, Gallagher, Langer, and Drinka, 1990). This trend suggests more than 1/3 of people over the age of 65 have impaired hearing. This indicates a need for further research and resource allocation to determine the scope and severity of problems that emerge from hearing loss. Hearing aids can often improve hearing loss (Lamden, Leger, and Raveglia, 1992; Mulrow, Tuley, and Aguilar, 1992) but many older people refuse to wear them (Wilson, Fleming and Donaldson, 1993), while others receive little benefit from their hearing aid at all.

The purpose of this study is to determine if hearing impairment is associated with depression and increased social isolation of elderly residents in complex continuing care facilities. There has been little research linking hearing impairment to depression and social isolation and what does exist is inconclusive.

There are two methods used to determine hearing loss, the physical measurement of pure tone hearing screening and qualitative measures such as the MDS Communication/Hearing

Pattern questions (Hopper et al., 2001), the Hearing Handicap Inventory for the Elderly (McBride, Aguilar, Mulrow and Tuley, 1990), or the Self Assessment of Communication (Schow and Nerbonne, 1982). This particular study used qualitative measures of Functional Hearing Impairment (FHI) provided by the Minimum Data Set 2.0 (MDS). A subsequent section will outline the reasons for using these measures.

The MDS is an informant rating scale used to monitor the progress of residents in complex continuing care facilities in Ontario. The MDS is an encompassing tool, administered by nursing staff, that measures mood and affect, hearing and communication ability, functional status, disease diagnosis, plus a whole host of other indexes. All complex continuing care facilities in Ontario are mandated to use the MDS, with the data deposited with a central agency, The Canadian Institute of Health Information.

The expectation is that hearing loss leads to higher levels of depression and social isolations (higher levels of anhedonia, less social engagement, and lower activity levels). These effects of hearing loss are expected because an individual's ability to communicate is important for maintaining quality of life. Hearing loss affects one's ability to communicate with and understand others. A significant loss of hearing may inhibit communication with nurses, other staff,

and family members. Hearing loss may also have adverse effects on medical treatment because of diminished communication between the residents and staff.

Hearing loss interventions are implemented more often in younger populations compared to the elderly, (Burnip and Erber, 1996). Hearing assessment programs for the elderly are often underdeveloped or nonexistent; reducing the chances for elderly complex continuing care residents with hearing loss to be treated effectively (Burnip and Erber).

The ability to communicate effectively is important in all age groups: young, middle aged, or elderly. Age or place of residence does not diminish an individual's need to communicate effectively (i.e., community, complex continuing care facility, or long-term care facility). However, this appears to be happen infrequently; for example, Hopper, Bayles, Harris, and Holland (2001) found that even though long term care residents in their study were identified as hearing impaired, none had received the appropriate corrective services at follow up, which may influence their overall well-being and have a negative effect on the care they receive.

Hearing impairment may hinder the sharing of medical information between health care staff and residents (Resnick et al., 1997). These communication problems may subsequently cause elderly individuals to appear more severely cognitively

impaired than they really are (Uhlmann, Larson, Rees, Koepsell, and Duckert, 1989).

For reasons outlined previously, it is easy to acknowledge the important role that communication has for the elderly. The ability to communicate effectively has been shown to be important for their physical and mental well-being and may affect the care they receive in complex continuing care facilities.

Literature Review

Physiology of Hearing and Hearing Loss

The conversion of sound into neuronal activity is very complex. The following review is based on Carlson and Buskist (1997) unless otherwise stated. What is involved with hearing sound are sound waves influencing a number of structures. Sound waves vary in both pitch (frequency) and loudness (intensity). Differences in pitch and loudness provide different sounds, making hearing possible.

The ear canal funnels vibrations caused by sound waves to the eardrum, thus allowing the eardrum to vibrate. Connected to the eardrum is an area called the middle ear, it contains the three small bones known collectively as the ossicles: hammer, anvil, and stirrup. Working together, these three bones relay

vibrations felt by the eardrum in a piston type fashion into the inner ear.

The inner ear houses two main structures, the vestibule, and the cochlea. The vestibule is an enclosed bony structure filled with fluid and characterized with two small openings covered by a membrane: oval window and the round window. The last of the ossicles, the stirrup, is pressed against the membrane of the oval window allowing vibrations to be passed along and transmitted into the fluid filled vestibule.

The cochlea is attached to the vestibule and is where vibration is changed into electrical impulses. Its shape resembles that of a snail. The cochlea is divided in two by a tissue called the basilar membrane and is lined with small hairs that, when flexed by vibration, cause electrical impulses to be sent through neural pathways. Since the size and contour inside the cochlea differs throughout, different sounds cause specific components of the basilar membrane to vibrate; high pitch sounds are more likely to cause the small hairs to vibrate towards the end of the cochlea whereas low pitch sounds are more likely to cause cells to vibrate towards the beginning.

Toward the end of the cochlea is a membrane referred to as the round window. Because fluid is unable to expand and contract when responding to the vibrations, movement of the

fluid within the ear caused by vibrations needs somewhere to go. The function of the round window is to facilitate the travel of vibrations through the length of the cochlea by moving back and forth in response to the movement of the fluid caused by the vibrations.

Auditory hair cells connect the Tectorial membrane to the basilar membrane by cilia. Vibrations entering the cochlea cause the cilia connecting the basilar membrane and Tectorial membrane to stretch, the stretching action triggers a reaction in the auditory hair cell, converting sound waves into neural activity. The auditory nerve sends the neural to the brain for further processing.

The process of hearing is complex and damage in any one of the areas can cause significant hearing loss. In some cases, hearing loss occurs because of a waxy build up in the ear canal causing occlusion, preventing sound waves from passing through to the eardrum. Premorbid hearing levels can be fully restored by removing the waxy substance. However, hearing impairment can also occur because of damage to the middle ear, inner ear, or because of neural loss.

Conductive deafness refers to hearing loss resulting from structural damage of the middle ear; for example, damage to one or more of the ossicles; often caused by disease. Sensory deafness refers to damage of an inner ear structure, causing

significant hearing loss. Neuronal deafness is a third type of hearing loss. It is caused by injury to either the auditory nerve and/or the central auditory system. These last three types of hearing impairment are usually inoperable (Canadian Hearing Society, 2002).

Presbycusis is age related hearing loss (Whitbourne, 1998). Presbycusis is the result of both sensory and/or neural loss resulting in deafness with neural loss more often associated with late onset depression (Kalayam et al. 1995). Hearing impairment can become the consequence of a number of factors but the result is always the same.

Measuring Hearing Loss

There are two ways to measure hearing impairment. First, it describes the physical measure of intensity, that is, the number of decibels lost from normal hearing. Voeks et al. (1990) stated that "hearing thresholds are typically categorized in the following manner: normal, 0-25 dB hearing level (HL); mild loss, 26-40 dB HL; moderate, 41-55 dB HL; moderately severe, 56-70 dB HL; severe, 71-90 dB HL; and profound, greater than 90 dB HL" (p. 141).

The second method to measure hearing impairment is using qualitative measures. The term *functional hearing impairment* describes operative hearing qualitatively by utilizing an

informant rating scale rather than quantitatively by measuring decibels. Advantages to this type of measurement include relatively simple training procedure for hearing loss assessment and widespread use of tools such as the MDS.

Hopper et al. (2001) was the first and only study to use the MDS to examine the effects of FHI on individuals suffering from dementia. They compared nurses' estimates of hearing loss with a pure-tone hearing screening test. The participants in their study were 57 long-term care residents who had a diagnosis of dementia.

Hopper et al. (2001) showed no relationship between the MDS communication scores and the pure-tone screening test. However, this occurred because none of the long-term care residents in the study had passed the pure-tone screening test. The reason for this may be that all of the residents suffered from some degree of dementia. However, Hopper et al. did state, "A significant difference in speech recognition ability was found" (p. 375), referring to the linguistic communication scores found in the MDS. They noted that the measures of linguistic communication in the MDS could predict FHI scores. Residents with FHI achieved significantly lower scores on linguistic communication (understanding others and being understood by others) than residents without FHI. Therefore,

the inference that can be drawn is that the MDS measure of FHI provides a valid estimate of hearing impairment.

Hopper et al. (2001) posited "if MDS ratings on items related to linguistic communication are valid indicators of communication function, then a significant difference in communication abilities should exist between individuals rated on the MDS as normal and those rated as [hearing] impaired" (p. 374). What Hopper et al. did was create dichotomous variables using the FHI scores and the linguistic communication scores (making self understood and ability to understand others). Residents in their study were categorized as hearing impaired if any score greater than 0 was recorded. Residents were also categorized as having some degree of linguistic communication impairment if any score greater than 0 was recorded on either of the linguistic communication items.

Their analysis showed that residents categorized as hearing impaired had significantly higher scores in linguistic communication impairment compared to residents who were not hearing impaired. By repeating this analysis, this study hopes to add further evidence on the validity of the MDS as a tool to distinguish between residents with and without FHI.

Hearing Aid Use

When hearing loss becomes a problem hearing aids are commonly used. Research has shown that "most older adults who use hearing aids experience a significant reduction in the degree of self-perceived emotional and social handicap" (Weinstein, 1994, p. 44).

Hearing aid devices typically consist of a microphone, receiver, and amplifier (Goffinet, 1992). They function to increase the degree of amplification, also known as "gain." The gain achieved by most hearing aids is 60 decibels; however, the degree of gain can vary among hearing aids through automation or switches.

Common misconceptions of hearing aids are that they fix hearing loss just as eyeglasses fix poor eyesight. In reality, hearing aids only serve to amplify sound, sometimes making background noise problematic (Tellier, 2002).

Advances in technology have allowed electrical components to become smaller (Dirks, n.d.). This miniaturization has allowed hearing aids to become less intrusive to the eye, sometimes going unnoticed. Even though these developments have been able to increase the flexibility of hearing aids to match the needs of the hearing impaired, they may sometimes come at a cost to quality. For example, the size of the microphone can affect the overall quality of sound amplification. Typically,

microphones are not able to pick up the entire range of pitch and the smaller they are the greater the range restriction.

Support showing the positive effects of hearing aid use on hearing impairment indicates hearing aids reduce hearing loss through the amplification of sound. However, hearing aids are effective only when used properly. Sometimes individuals who require a hearing aid refuse to use it (Popelka et al., 1998). The most common type of hearing aid is visible to the eye, may be unattractive, and may be ineffective in group situations because of background noise, causing the resident to proscribe the hearing aid.

Stigmatization is a problem for hearing aid users; however, older age groups do not stigmatize the use of hearing aids (Iler, Danhauer, and Mulag, 1982) but younger age groups do (Blood, Blood, and Danhauer, 1977; 1978). Consequently, the hearing impaired may refuse to wear a hearing aid or only wear the hearing aid only in certain situations.

Studies examined the effect of hearing aid use on indexes such as perceived hearing handicap. Tesch-Romer (1997) observed a group of older adults with mild to moderate hearing impairment that received a hearing aid for the first time (n = 70). They found a positive effect on perceived hearing handicap when elderly residents began to use hearing aids. Residents

were less likely to complain about hearing problems when given a hearing aid.

Effects of Hearing Impairment

The present study examined the effects of FHI on the following indexes of function and well being: Linguistic communication, cognition, activities of daily living, depression, and social isolation.

Linguistic Communication. Humes et al. (1994) examined the usefulness of speech recognition to determine levels of hearing impairment. They used a sample of 50 participants aged 63 to 83 and tested the participants using a number of different materials in a variety of listening conditions. They stated, "among this group of 50 elderly listeners, individual differences in hearing loss were the primary determinants of individual differences in speech-recognition ability" (Humes et al., p. 472). The effect that cognitive function had on speech-recognition was not significant in their study. As stated previously, the MDS records linguistic communication (ability to understand others and making self understood) instead of speech recognition. Since perceived linguistic communication influences cognition, it is important to account for cognitive impairment, delirium, and dementia in the analyses. By

controlling for these variables, any effect that FHI has on linguistic communication will be due to hearing ability rather than cognition.

Cognition. Hearing impairment is sometimes a consequence of neural loss resulting from dementia. As stated previously, the physiology of hearing includes two neuronal structures; auditory nerve and the central auditory system. These neuronal systems have been associated with "altered cognitive function due to primary sensory deafferentation" (Sinha, Hollen, Rodriguez, and Miller, 1993). However, not all kinds of cognitive impairment reflect prodromal symptoms of dementing disorders.

Residents with hearing loss may appear more cognitively impaired than they really are because they are unable to understand others and/or communicate effectively. In addition to depression, hearing loss is a strong risk factor for acute confusion (Cacchione, Culp, Laing, and Tripp-Reimer, 2003), and poor performance in the Mini-Mental State Examination (Naramura et al., 1999; Raiha et al., 2001). Weinstein and Amsel (1986) have also found associations between severity of hearing loss and scores on the mental status questionnaire. In addition, these authors reported that increased amplification using a hearing aid improved responses to the mental status

questionnaire, suggesting that hearing loss contributes to confusion.

It may be difficult to determine whether poor cognition (dementia, cognitive impairment, or delirium) is the cause or consequence of hearing impairment. However, it is possible that, in some cases, residents with cognitive impairment will appear more severely impaired because of their hearing loss. For these reasons, it is necessary to control for cognition as a possible confounding variable when examining hearing impairment in the elderly.

Activities of Daily Living. Activities of daily living have been associated with hearing impairment. Activities of daily living include such activities as the ability to toilet oneself, bath, dress, and be mobile. The likelihood of being unable to perform these functions increases with age (Quadagna, 1999).

The frail elderly must often rely upon others to help maintain their independence and remain in the community. These social support networks sometimes break down, leaving the older person unable to deal with the demands of everyday life. When this occurs, the elderly person may need to rely on assisted living programs to maintain their independence or sometimes

move towards institutional care (e.g. homes for the aged, nursing home).

Some studies relate hearing impairment to activities of daily living. Carabellese et al. (1993) used pure tone screening tests to examine the relationship between hearing impairment and self-sufficiency in activities of daily living. They used 1,192 people aged 70-75 who were living independently in the community. Carabellese et al. found a strong relationship between hearing impairment and self-sufficiency in activities of daily living. Their findings show that elderly individuals who are hearing impaired are less self-sufficient and rely more upon others for help.

Depression. The U.S. surgeon general estimates that the 1-year prevalence rate of the occurrence of any psychiatric disorder is 19.8% (U.S. Department of Health and Human Services, 1999; cited by Powers, Thompson, Futterman, and Gallagher-Thompson, 2002). For the elderly living in residential care facilities the prevalence rate of major depressive disorder is approximately 15% (Parmelee, Lawton and Katz, 1989); however, when subsyndromal depression is included, rates are approximately 20% (Blazer, 1991), with some estimate nearing 35% among older primary care residents (Gurland, Cross and Katz, 1996).

Hearing loss is associated with the timing of the first onset of depression. Kalayam et al. (1995) found that elderly individuals presenting with late onset depression (i.e., the first depressive episode after the age of 65) were more likely to be hearing impaired than individuals with early onset depression. In addition, neural deficits that are associated with presbycusis are more likely to occur in association with late onset depression (Kalayam et al.). These findings have implications for research on the early signs of dementia.

Historically, studies examined depression as the result of change in biological or psychosocial factors. Today, studies have begun to focus on the impact that depression has on variables like cognition and quality of life (Powers et al., 2002). The present study examined the influence of hearing loss on symptoms of depression and the consequent effect that depression may have on social isolation in complex continuing care residents.

The MDS measures symptoms of depression using the Depression Rating Scale (DRS; Burrows, Morris, Simon, Hirdes, and Phillips, 2000). The DRS was developed to identify individuals who may suffer from symptoms of depression. It has been validated against the Hamilton Depression Rating Scale and the Cornell Scale for Depression in Dementia. Developers of the DRS found it to have greater sensitivity and specificity to the

identification of symptoms of depression than the Geriatric Depression Scale in their group of participants.

Previous studies examining the relationship between hearing loss and depression cite arguments both for and against an association (Cacciatore et al., 1999; Kalayam et al., 1995; Sloan and Dancer, 2001).

Sloan and Dancer (2001) utilized forty study participants from upper socioeconomic retirement centres located in the United States and found no difference in depressive symptoms when comparing individuals with and without hearing loss. They stated, "[for] affluent adults living in high amenity retirement settings, the consequences of a hearing loss, including depression, may be minimized by an environment that offers substantial accommodations to residents needs" (p. 1254). It is possible that the standard of care received by residents of upper class retirement centres far exceeds that of other facilities, such as complex continuing care facilities, allowing for a greater chance that hearing impairment will be detected and fixed.

Cacciatore et al. (1999) conducted a study in Italy using 1,332 participants aged 65-96. They demonstrated three significant effects of hearing loss. The first indicated that hearing impairment is associated with higher scores on the Geriatric Depression Scale, suggesting higher levels of

depressive symptoms. The second effect was a strong association between hearing loss and cognitive impairment. Participants who were cognitively impaired were more likely to display hearing loss, though the direction of causality was difficult to determine. The third effect was that hearing aid use is associated with reduced symptoms of depression.

The evidence provided by Cacciatore et al. (1999) allows the following inferences to be drawn:

- Hearing impairment is associated with both symptoms of depression and problems of cognition, and
- Symptoms of depression are reduced when hearing aids are worn and used properly.

Consequently, individuals experiencing hearing loss may feel a sense of helplessness, passivity, or depression when unable to hear conversations directed at them.

Social Isolation. Measures of social isolation include anhedonia (loss of interest or pleasure in social activity), reduced sense of social engagement, and a lower level of activity.

Research by Resnick, Fries and Verbrugge (1997) included data from 18,873 nursing home residents and showed that moderate to severe hearing impairment is associated with decreased social engagement and low activity levels. The

results of their study suggest a strong association with the quantity, rather than quality, of time spent in activity. They also implicate social isolation as a problem because people who are hearing impaired are more likely to isolate themselves from other. They stated:

> In a simple model that included ordered sensory abilities and no interaction terms, severe hearing impairment was associated with 42 percent greater prevalence of low levels of social engagement, and 30 percent greater prevalence of little or no time involved in activities. (p. S142)

This finding suggests that individuals experiencing hearing loss may feel a sense of helplessness and passivity when unable to hear conversations directed at them. Resnick et al. posited that hearing impairment may invariably lead to restricted social engagement. It seems only natural that residents experiencing difficulty communicating are less likely to engage in social activities. Clearly, the ability to communicate is essential to maintain social engagement.

Research by Weinstein and Ventry (1982) has found an association between hearing loss and social isolation among the community dwelling elderly. Using a number of tests (pure-tone testing, speech discrimination testing, and self-assessed hearing handicap), Weinstein and Ventry were able to determine

that measures of subjective isolation were strongly associated with hearing loss. In fact, subjective scores of isolation were more strongly associated with hearing loss than objective scores.

Hypotheses

Two hypotheses were examined in the present study: (a) that level of FHI is directly related to higher symptoms of depression, and (b) that complex continuing care residents with FHI experience reduced social interaction (i.e., a loss of interest in social activity, a reduced sense of initiative to become involved in group activity, and low levels of activity).

Method

Database

The Canadian Institute of Health Information (CIHI) is an agency that serves to monitor the health of Canadians and the success of the Canadian health care system through the diffusion of reliable and timely health information. The following information has been provided by CIHI. It is mandated to provide data:

- For the establishment of health policy,
- For the coordination and promotion of the development and maintenance of national health information standards,

- To develop and manage health databases and registries,
- To participate in academic research,
- For the publication of reports and release health information and,
- For the education of the public.

The present data was made available through the Graduate Student Data Access Program. This program allows qualifying graduate students free access to the CIHI database provided the student's research questions address specific issues related to health.

For graduate students to access CIHI's data, they must provide evidence that the research fulfils the requirements of their program of study. Students must also follow strict ethical procedures set out by CIHI, such as ensuring that no identifying information (individual or institutional) be released. In addition, CIHI requires biannual reports on student progress for the duration of their research study.

CIHI's mandate includes the collection of health information from all residents in complex continuing care facilities in Ontario. Health care professionals initially record health information from each resident upon admission. Full assessments for each resident are also provided on an annual basis. Partial assessments are required on a quarterly basis, as well as when

a significant change or correction in health status has occurred.

Sample

CIHI provided the data for this study. The sample includes all residents in complex continuing care facilities in Ontario who were admitted between April 2000 and March 2001. The sample consisted of 16,937 residents before exclusion criteria were introduced.

Measures

Measures for linguistic communication, hearing loss, depression, and social isolation were based on items taken from the Minimum Data Set 2.0 (MDS). Additional items that are thought to be associated with FHI were also provided: diagnosis of dementia, delirium, cognition, and activities of daily living.

Minimum Data Set 2.0

The MDS (see Appendix A) is a wide-ranging instrument that measures the health and well-being of institutionalized residents in such areas as mood, behaviour, communication ability, disease, and mobility. Front-line staff trained to use this tool initially gathers information. Its use of

standardized definitions allows for accurate comparisons among residents and across complex continuing care facilities. The MDS is designed to be minimum set of items required for needs assessment. It can then be used to identify problem areas requiring further consideration.

Resident Assessment Protocols are built into the MDS and used to facilitate the formulation of a specific care plan for each resident. The occurrence of a problem triggers a Resident Assessment Protocol thereby alerting health care professionals to the specific area requiring further assessment. Although the impetus to problem identification remains on the health care professional, Resident Assessment Protocols can be used as either a primary or a secondary source of information.

An important aspect of the MDS assessment procedure is that residents are observed over long periods. Full assessments are initially carried out when a resident enters into a complex continuing care facility. Full assessments are then completed on an annual basis. Supplementary assessments are carried out quarterly or when a significant change in condition has occurred. This method provides accurate, comprehensive case histories for each resident.

The following measures were used.

Hearing Impairment

Measures of hearing impairment are obtained from the MDS Communication/Hearing Pattern index. This index measures both the level of hearing loss (FHI) and specifics on hearing aid use. The level of FHI is measured while the resident is using the hearing aid. FHI is measured on a 4-point Likert scale described in Table 1 (see next page).

The intent of these measures is to examine the resident's hearing ability during the last seven days. The MDS assessor is also instructed to consult the resident's family, staff members, and when appropriate, speech or hearing specialists. The assessor is trained to observe any possible signs that a problem may exist including: the resident's use of gestures, the residents need to see the assessor's face, how quiet the room has to be to conduct the interview, or how loudly the assessor must speak.

Table 1. The MDS Communication/Hearing Pattern index recounting the resident's ability to hear during the past 7 days.

Hearing Score	Description
Hear adequately	Resident is able to hear normal conversational speech (including telephone, watching television, and group activities)
Minimal Difficulty	The resident is able to hear normal conversational speech but has trouble hearing in situations with unacceptable background noise or when not in one-on-one situations.
Hears in special situations only	The resident is clearly hearing deficient and uses compensatory measures to adjust for the hearing loss.
Highly impaired	Conversational speech is not comprehended even when the speakers adjust their volume. The resident can only hear some sound and frequently does not respond to others.

(Centers for Medicare and Medicaid Services, 2003).

Two previous studies have shown good reliability of the MDS FHI measures using the Spearman-Brown intraclass correlation coefficient. Hawes et al. (1995) stated, "this measure [Spearman-Brown] generally provides a more conservative estimate of reliability than either simple correlation or percent agreement" (p. 174). There is agreement that a coefficient of .40 reflects good reliability and .70 or higher excellent reliability. Hawes et al. (1995) showed the reliability between assessors to be .84 for the hearing items in his study. A later study using the same statistical technique (Sgadari et al., 1997) compared the reliability estimates of seven countries and showed a range of scores of .39 to .84 with an average coefficient of .69. These studies indicate good to excellent reliability between assessors for measures of hearing impairment.

Hearing Aid Use

Items of hearing aid use are found in the Communication/Hearing section of the MDS. They are measured dichotomously and account for the past 7-day period (see Table 2).

Table 2. The MDS Communication/Hearing Pattern index recounting the resident's use of a hearing aid during the past 7 days.

Hearing Aid	Description
Present and used	A hearing aid or other assistive listening device is available to the resident and is used regularly.
Present and not used properly	A hearing aid or other assistive listening device is available to the resident and is not used regularly (e.g., resident has a hearing aid that is broken or is used only occasionally).

(Centers for Medicare and Medicaid Services, 2003)

How individuals use their hearing aid may be important since some individuals may tend not to wear their hearing aid regularly. It is often difficult to monitor hearing aid use accurately. MDS assessors record information provided by front-line staff. This provides an accurate reflection of how residents manage their hearing aids on a daily basis.

Linguistic Communication

Two measures were used to determine linguistic Communication: Making self understood and ability to understand others. These measures use a 4-point scale described in Table 3 and 4.

Previous studies showed good to excellent reliability for the linguistic communication items. A sample of 123 residents in the United States (Hawes et al., 1995) showed a reliability of .66 for the combined linguistic communication items. In a comparison study in seven countries, Sgadari (1997) reported reliability estimates that ranged from .49 to .89.

Table 3. The MDS Communication/Hearing Pattern index describing the residents ability to understand others during the past 7 days.

Understanding Score	Description
0. Understands	The Resident clearly comprehends the speaker's message.
1. Usually understands	The resident's ability to comprehend a verbal message is demonstrated repeatedly; however, a part or the intent of the message may be lost.
2. Sometimes understands	Frequent difficulties are displayed integrating information and resident responds to simple, direct questions of directions.
3. Rarely/Never understands	Limited ability to comprehend verbal communication or sounds can be heard but the resident does not understand it

(Centers for Medicare and Medicaid Services, 2003).

Table 4. The MDS Communication/Hearing Pattern index describing the resident's ability to be understood by others during the past 7 days.

Understood Score	Description
0. Understood	This describes the resident as able to express his or her ideas clearly
1. Usually understood	The resident sometimes has difficulty finding the right words or finishing thoughts.
2. Sometimes understood	The resident's ability is limited to expressing concrete requests regarding basic needs.
3. Rarely or never understood	The resident is unable to make him or herself understood and the staff must interpret their needs.

(Centers for Medicare and Medicaid Services, 2003).

Cognition

Dementia. The Disease Diagnosis index records diagnoses of dementia. Two items were used to record the diagnosis of any dementing illness: Alzheimer's disease and dementia other than Alzheimer's disease. According to the MDS manual, Diagnosis of dementia can only be recorded when documented by physician in the resident's chart. Dementia other than Alzheimer's disease includes the diagnosis of organic brain syndrome, chronic brain syndrome, senility, senile dementia, multi-infarct dementia, and dementia related to neurological disease (Picks, Creutzfeld-Jacob, Huntington's disease, etc.).

Cognitive Impairment. Not all residents with mild, moderate, or severe forms of cognitive impairment have a diagnosis of dementia. Therefore, the cognitive functioning of the residents must be measured to identify individuals who are cognitively impaired. Cognitive impairment was measured using the Lawton Scale (Lawton et al., 1998).

This measure includes items used to determine functional capacity for short and long-term memory. The memory items are calculated dichotomously: memory okay, memory problem. Four items are used to determine the resident's memory of their current environmental setting. Recall-ability on these items are measured by the presence or absence of recall for:

(a) Current season,

(b) Location of own room,

(c) Staff names/faces, and

(d) Knowledge that he/she is in a nursing home.

Because cognition is often difficult to assess, these items are essential to differentiate between residents who retain the capacity to respond to others and those who seem to recognize others but may be unaware of their current surroundings.

The final item measures the resident's cognitive skills. This is measured on a 4-point scale ranging from (0) independent to (3) severely impaired. The purpose of this item is to record the resident's ability to make decisions about everyday tasks or activities of daily living.

The Lawton Scale was found to have high reliability. Casten, Lawton, Parmelee, and Kleban (1998) reported a correlation between MDS assessors of 0.80 and a Kappa of 0.63. In a comparison of 7 countries, Sgadari et al. (1997) reported Spearman-Brown coefficients ranging from 0.64 - 0.88.

The Lawton Scale (Lawton et al., 1998) was chosen as a measure of cognition rather than the more popular Cognitive Performance Scale (Morris et al., 1994). This decision was made because the Cognitive Performance Scale uses items that are also found in other indexes used by this study. For example, an

item measuring the resident's ability to eat is found in the Activities of Daily Living - Short Form (Morris, Fries, and Morris, 1999), and the capacity for residents to make themselves understood is found in the Linguistic Communication Scale (Hopper et al., 2001).

Delirium. The Items of Delirium describes two conditions. First, a state characterized by a recent change in cognitive functioning that may be caused by a treatable illness, overmedication, or a reaction to specific types of medication. The second describes a persistent condition that is not of recent onset. The items of delirium are found in Table 5.

MDS items measure behaviours that occurred within the previous seven days or over a longer period.

(0) Behaviour not present,

(1) Behaviour present, not of recent onset, and

(2) Behaviour present over last seven days appears different from resident's usual functioning.

Table 5. *Items of Delirium* index

Delirium Items	Description
Easily distracted	Difficulty paying attention; gets sidetracked.
Periods of altered perception or awareness of surroundings	Moves lips or talks to someone not present; believes he or she is somewhere else; confuses night and day.
Episodes of disorganized speech	Speech in incoherent, nonsensical, irrelevant, or rambling from subject to subject; loses train of thought.
Periods of restlessness	Fidgeting or picking at skin, clothing, napkins, etc.; frequent position changes; repetitive physical movements or calling out.
Periods of lethargy	Sluggishness, staring into space; difficult to arouse; little body movement.
Mental function varies over the course of the day	Sometimes better, sometimes worse; behaviours sometimes present, sometimes not.

(Centers for Medicare and Medicaid Services, 2003).

Activities of Daily Living

The ability to function in everyday activities and to engage in self-care tasks is measured by activities of daily living. This study used the Activities of Daily Living - Short Form (Morris, Fries and Morris, 1999) to determine functional ability because of its high internal consistency (Cronbach's alpha = 0.90; Morris, Fries and Morris). The activities of daily living items are coded to measure level of independence on a 4-point scale:

0, Independent,

1, Supervision,

2, Limited assistance,

3, Extensive assistance, and

4, Total dependence

(Note. Each response stating, "activity did not occur" was converted to "total dependence," Morris, Fries and Morris, 1999)

The Activities of Daily Living - Short Form employs 4 items:

1) Personal hygiene - includes activities such as washing, combing hair, and brushing teeth;
2) Toilet use - the ability for residents to toilet themselves;
3) Locomotion on unit - ability to move around the facility; and

4) Eating - capacity to eat regardless of skill.

These skills represent the ability to maintain and care for oneself and to indicate the level of care that may be required. Scores on the Activities of Daily Living - Short Form range of 0-16.

Depression

The MDS DRS comprises seven items:

(a) Resident made negative statement,

(b) Persistent anger with self or others,

(c) Expressions of what appear to be unrealistic fears,

(d) Repetitive health complaints,

(e) Repetitive anxious complaints,

(f) Sad, pained, worried facial expressions, and

(g) Crying, tearfulness.

These items are scored on a 3-point scale:

(0) Indicator not exhibited in last 30 days,

(1) Indicator of this type exhibited up to five days a week, and

(2) Indicator of this type exhibited daily or almost daily.

Scores from each item are tallied, providing a symptom scale of 0 - 14. The internal consistency is acceptable with a

Cronbach's Alpha of .75 (Burrows et al. 2000). In addition, the MDS DRS correlated highly with the Hamilton Depression Scale and the Cornell Scale while maintaining sensitivity for detecting depression of 91% when tested against psychiatric diagnosis (Burrows et al., 2000).

Social Isolation

Anhedonia. Research has implicated that the MDS items on "loss of interest" regarding social activities may be a proxy for anhedonia (Stones, 2000; Stones and Kirkpatrick, 2002). Anhedonia is regarded as a state of low positive affect. It is characterized by diminished interest in pleasurable activities and an inability to feel pleasure or happiness.

Anhedonia was measured using the section on Mood and Behaviour Patterns in the MDS:

(a) Withdrawal from activities of interest, and

(b) Reduced social interaction.

These two items are measured on the same scale as the DRS (see section on depression).

Social Engagement. The MDS Psychosocial Well-being index provides items of social engagement (Mor et al., 1995). Theses items apply to the sense of initiative/involvement. The social engagement index comprises six items:

(a) At ease interacting with other,

(b) At ease doing planned or structured activities,

(c) At ease doing self-initiate activities,

(d) Establishes own goals,

(e) Pursues involvement in life of facility, and

(f) Accepts invitations into most group activities.

The items measure the presence or absence of social engagement among nursing home residents. Studies have shown the items to have high reliability (Cronbach's Alpha = .79; Mor et al., 1995).

Activity Level. The Activity Pursuit Patterns index measured the amount of time involved in activities. The average time involved in activity is measured on the following scale:

- Most - more than 2/3 of the time,
- Some - from 1/3 to 2/3 of the time,
- Little - less than 1/3 of the time, and
- None.

Activity level is an overall measure of free time in activities that do not include time involved in nursing care, treatments, or activities of daily living.

Results

Preliminary Analyses

Database

Information was obtained on 16,937 complex continuing care residents. Nevertheless, a number of residents were removed from the sample for one or more of the following reasons:

- Comatose/vegetative state (n = 366),
- Absence of speech (n = 2,578),
- Age less than 65 years old (n = 3,093), and
- Missing information on measures of FHI and hearing aid use (n = 909).

After removal, data from 12,254 residents living in throughout Ontario was available for further analysis.

Age and Gender

The average age of the complex continuing care residents was 80.72 (sd = 7.54, see Figure 1) years of age. The sample consisted of 5,121 men (42%) and 7,133 women (58%). The age difference between men ($mean$ = 79.46, sd = 7.14) and women (mean = 81.63, sd = 7.69) was small but significant [F (1, 12,252) = 251.69, p < .001].

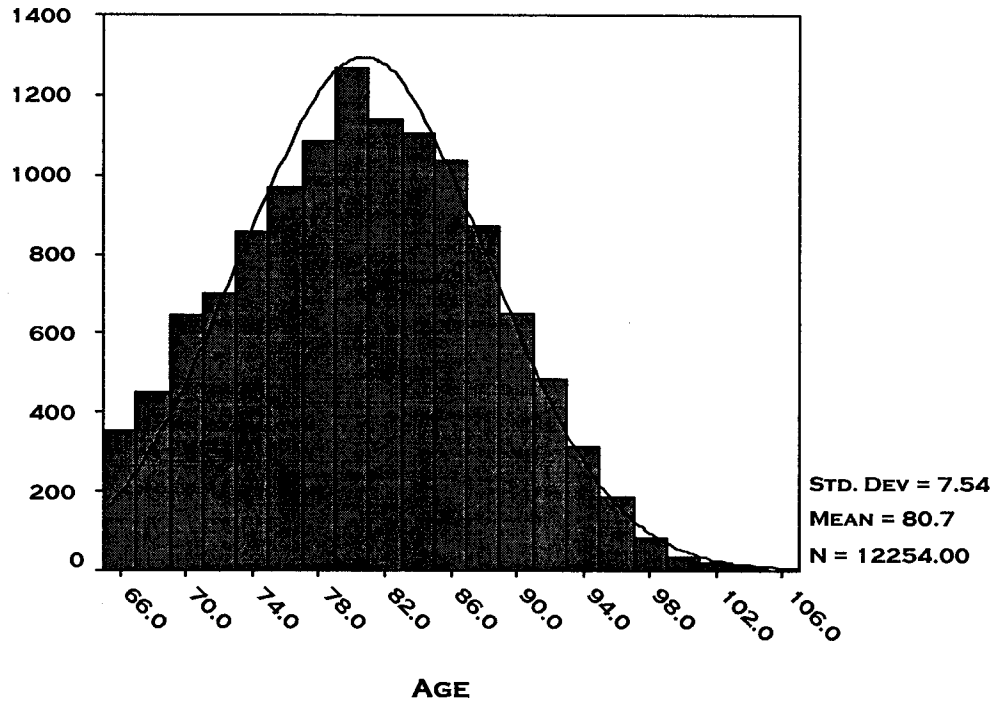

Figure 1. The distribution of age with normal curve. Note the cut-off age of 65.

Reason for Assessment

Preliminary analysis found that the majority of residents were newly admitted to complex continuing care and relatively few were assessed because of an annual assessment (see Table 6.). The high number of initial assessments provides an indication that stays in complex continuing care were shorter than one year.

Table 6. Reason for assessment.

Status	N
New Admission	10,046
Annual Assessment	1,741
Significant Change	450
Significant Correction	17

Hearing Impairment

Because few residents were highly impaired, a decision was made to combine this group with those who hear in special situations only, creating a group labelled "moderate/severe FHI." Consequently, there were three levels of FHI (no FHI, mild FHI, and moderate/severe FHI).

Further analysis examined the prevalence of FHI. Results showed that a large segment of residents had normal hearing (n = 7,932) compared to the mild FHI group (n = 2,834) and the moderate/severe FHI group (n = 1,488).

Hearing Aid Use

The majority of residents were not using any hearing aid device (n = 10,620), compared to 1,634 residents who did use a hearing aid. However, of the residents who wore a hearing aid, 1,177 residents used the devices on a regular basis and 457

residents had a hearing aid but did not use it on a regular basis.

It was important to determine the relationship between level of FHI and hearing aid use (see Table 7) and audiological services (see Table 8). A crosstable between FHI and hearing aid usage showed that a fairly high proportion of residents with FHI were using no hearing aid device at all. Results also show that residents with FHI may not be receiving audiological services; very few were reported to receive any type of Speech-language pathology or audiology services (see Table 8.).

Table 7. Level of FHI by Hearing Aid use.

	Hearing aid use	
	No	Yes
No FHI	7,590	342
Mild FHI	2,216 **	618 *
Moderate/Severe FHI	814 **	674 *

The values represent the actual numbers of complex continuing care residents in each group. * Notice that a large number of residents with hearing aids still record hearing loss. ** A large number of residents with hearing loss do not have a hearing aid.

Table 8. Level of FHI by Speech-language pathology or audiology services.

	Speech-language Pathology or Audiology Services	
	No	Yes
No FHI	7,367	565
Mild FHI	2,584 *	250
Moderate/Severe FHI	1,370 *	118

*The values represent the true numbers of residents who did or did not receive services. * Notice that a large number of residents with hearing loss record no Speech-language Pathology or Audiology Services.*

Linguistic Communication

Linguistic communication was assessed using the two communication items on the MDS. A reliability analysis indicated excellent consistency (Cronbach's alpha = .86). Table 9 shows the number of residents in each group. Because of the large number of residents, a decision was made to first dichotomize each item and then place each resident into one of four groups: 1, Problem making self understood; 2, Problem understanding others; 3, Problem being understood and

understanding others; 4, no problem understanding others and being understood.

Table 9. Number of residents in each group described by the communication items.

Making self understood	Frequency	Percent
Understood	7,241	59.1
Usually Understood	2,935	24.0
Sometimes understood	1,627	13.3
Rarely/never understood	451	3.7
Understanding Others	**Frequency**	**Percent**
Understands	5,969	48.7
Usually understands	3,669	29.9
Sometimes understands	2,139	17.5
Rarely/never understands	387	3.1
Unknown	99	0.8

Cognition

Measures of cognition included the Lawton Scale, delirium, and dementia.

Lawton Scale. Cognition was assessed using the Lawton Scale (Casten, Lawton, Parmelee and Kleban, 1998). A

reliability analysis performed on this scale showed excellent reliability (Cronbach's alpha = .88) with no improvement after the deletion of any item. The distributions of scores were reasonably dispersed along the continuum (see Figure 2) with the modal score indicating no cognitive impairment.

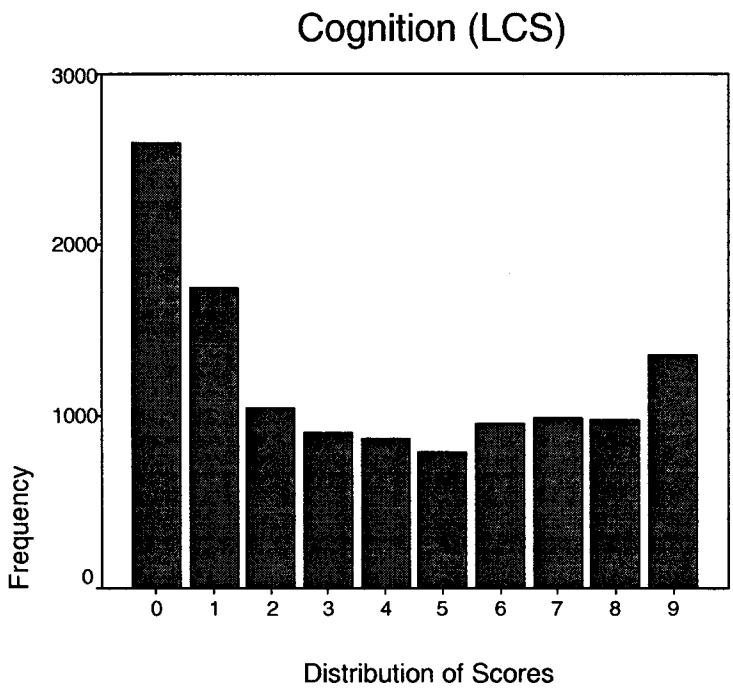

Figure 2. Distribution of Scores recorded on the Lawton Cognition Scale.

Delirium. The state of delirium was assessed using the delirium index provided by the MDS. Half of all residents experienced no symptoms of delirium. A reliability analysis indicated excellent consistency (Cronbach's alpha = .89) with

only a small improvement with the deletion of item 5 (periods of lethargy). Figure 3 shows the distribution of scores.

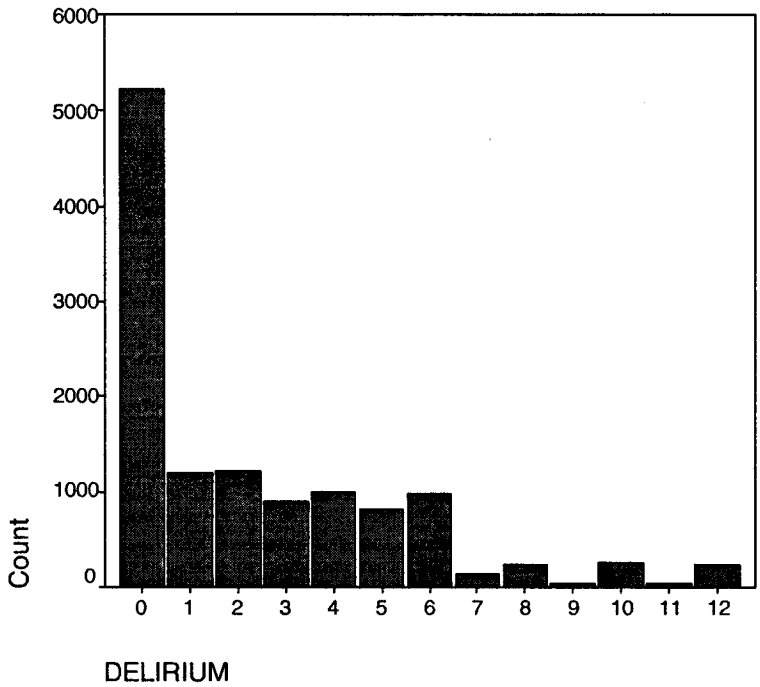

Figure 3. Distribution of Scores recorded on the Delirium index.

Dementia. Items of dementia were measured as either the diagnosis of Alzheimer's disease or a diagnosis of dementia other than Alzheimer's disease. Results showed that 9,343 residents did not have any diagnosis of dementia, 840 were diagnosed with Alzheimer's disease, 2,007 were diagnosed with dementia other than Alzheimer's disease, and 64 were diagnosed with both.

Activities of Daily Living

Activities of daily living were fairly evenly dispersed along the continuum (see Figure 4). A reliability analysis revealed excellent internal consistency (Cronbach's Alpha = 0.82) with moderate improvement with the deletion of one item (locomotion on unit); however, since the improvement was modest, a decision was made to include the item in further analyses.

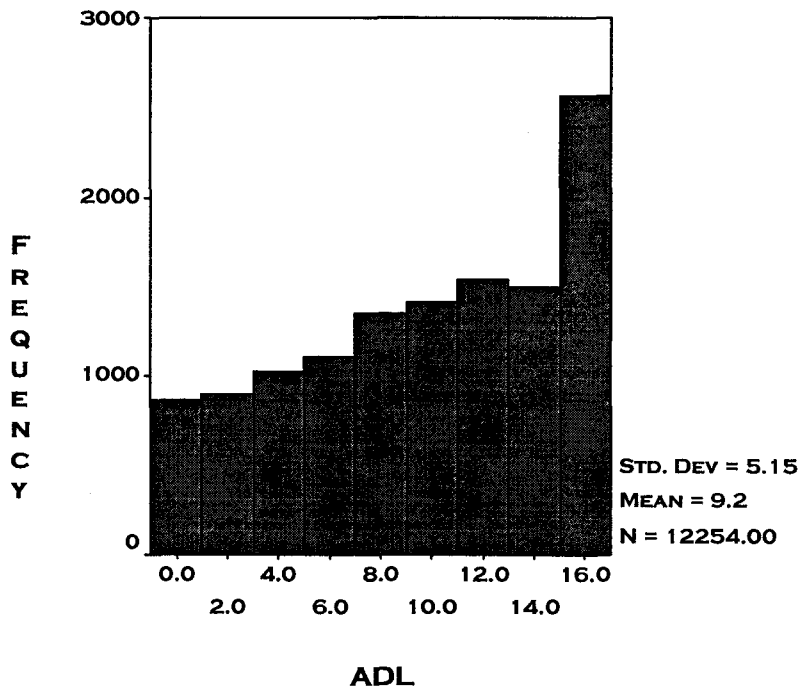

Figure 4. The distribution of Activities of Daily Living scores.

Depression

Symptoms of depression were measured using the DRS. Results of the reliability analysis indicate good internal consistency (Cronbach's alpha = 0.75). No improvement with deletion of any of the items was found. Scores on the DRS ranged from 0-14 with a mean of 1.63 (sd = 2.37). Figure 5 shows the distribution of scores.

A decision that was based on earlier research (M. Stones, personal communication, June 27, 2004) was made to categorize scores into three distinct groups: 0-2, no symptoms of depression; 3-5, mild Symptoms of depression; and 6-14, moderate/Severe symptoms of depression.

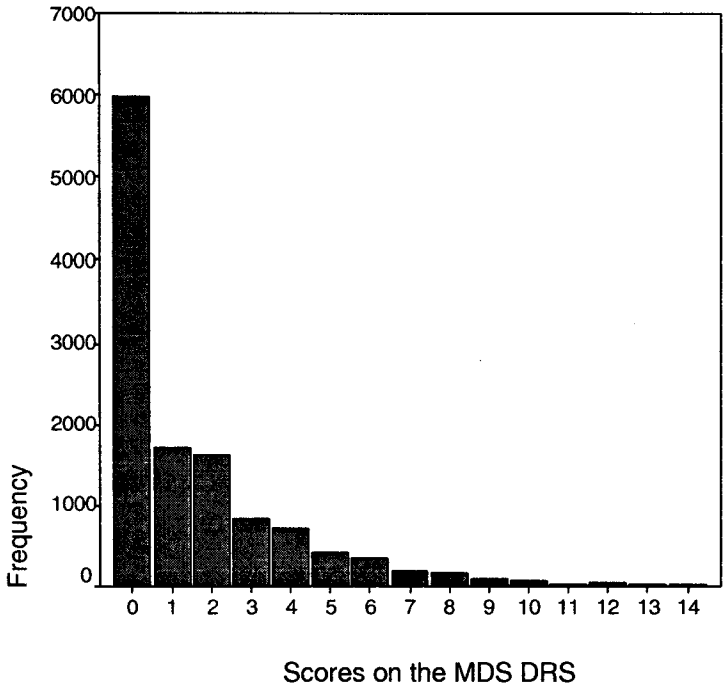

Figure 5. Distribution of Scores Recorded on the Minimum Data Set - Depression Rating Scale.

Social Isolation

Measure of social isolation included anhedonia, social engagement, and activity level.

Anhedonia. Anhedonia was measured using the *Loss of Interest* items found in the Mood and Behaviour Pattern index. Results of the reliability analysis indicate excellent reliability (Cronbach's alpha = .90). Figure 6 illustrates that the majority of residents did not record any anhedonia. Scores

on anhedonia range from 0-4 with a mean of .79 (sd = 1.33). A decision was made to dichotomize the anhedonia variable so that 0 equals no anhedonia and 1 or more signifies the presence of anhedonia.

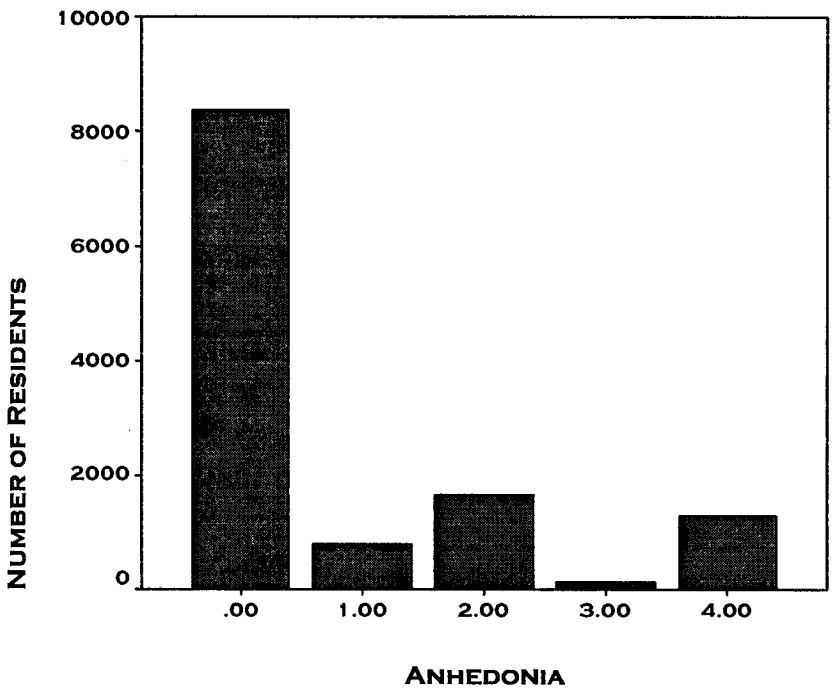

Figure 6. Distribution of Anhedonia scores.

Social Engagement. Social engagement was measured using the Sense of Initiative/Involvement items found in the Psychosocial Well-being index. The reliability analysis showed excellent reliability (Cronbach's alpha = .80). Scores were evenly distributed along the continuum (Figure 7.) and ranged from 0-6 with a mean of 2.34 (sd = 1.97). In subsequent

analyses, the scores were dichotomized (0 = no social engagement, 1 = any social engagement).

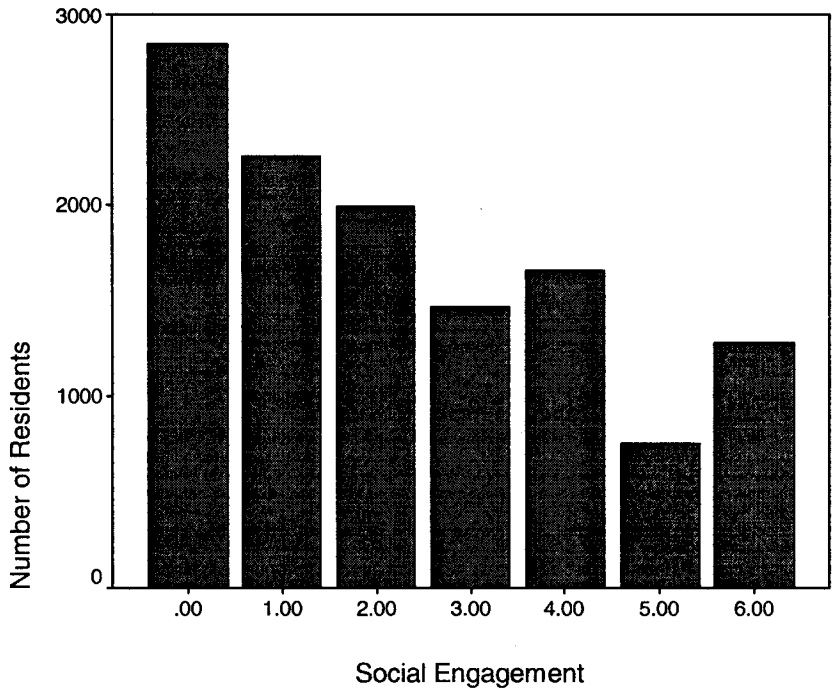

Figure 7. Distribution of Social Engagement Scores.

Activity Level. Activity level was measured by the MDS by one variable. A decision was made to dichotomize this variable in subsequent analyses. Residents who spend less than 2/3 of their time were rated as 0 and residents who spent more than 2/3 of their time were rated as 1.

Correlates of FHI

Correlations between FHI and other variables were examined. Age was associated with FHI (r = .27, p < .001). The

average age of residents in the moderate/severe FHI group was 85.0 years old (*sd* = 7.38) compared with younger ages in the Mild FHI group (mean age = 82.3, *sd* = 7.26) and the no FHI group (mean age = 79.3, *sd* = 7.25).

Significant correlations were found between FHI and the Lawton Scale, (r = .21, p < .001), delirium (r = .17, p < .001), dementia (r = .12, p < = .001), and activities of daily living (r = .13, p < .001.

Main Analyses

Multinomial Logistic Regression

Multinomial logistic regression is a technique used to predict a categorical variable by one or more variables that are categorical, continuous, or a mix.

Multinomial logistic regression is different from other parametric techniques (multiple regression) because there are no conventional parametric assumptions about the variables. For example, the independent variable(s) do not need to be normally distributed, linearly related, and do not need equal variance within each group.

This technique uses an iterative procedure to estimate the regression coefficients (maximum likelihood ratios).

$$\hat{Y}_i = \frac{e^{a+B_1X_1+B_2X_2+\ldots+B_kX_k}}{1+ e^{a+B_1X_1+B_2X_2+\ldots+B_kX_k}}$$

The predicted variable, $\hat{Y}$, is based on a nonlinear function of the best linear combination of predictors.

In the present study, logistic regression analyses were used to predict group membership using the NOMREG function found in SPSS 10. This technique allowed the author to predict the dependent variables of linguistic communication, hearing aid use, depression, and social isolation by FHI. The author also included variables to control for other effects correlated with hearing impairment (e.g., delirium, dementia, Lawton scale, and activities of daily living).

The coefficients in multinomial logistic regression are odds ratios (OR). A predictor with an OR of 1.0 provides no predictive value in the model. An OR that is greater than 1.0 or less than 1.0 with a 95% confidence interval (CI) that does not include one does is significant at $p < .05$. The CI determines the degree of significance. This means that the true OR has a 95% chance of resting somewhere between the lower and upper bound CI. Therefore, a CI with a range that does include 1.0 is non-significant.

Linguistic Communication

The author examined the relationship between FHI and linguistic communication. FHI was the independent variable and linguistic communication was the dependent variable. Delirium, cognition, and diagnosis of dementia were used a control variables.

Results from this study were consistent with Hopper et al. (2001). FHI could differentiate between levels of linguistic communication. Table 10 illustrates the relationship between FHI and linguistic communication. By removing the effects of cognition (cognitive impairment, delirium, and dementia), the odds ratios in Table 10 generally represent significant effects of FHI on linguistic communication.

Table 10. Level of FHI by Linguistic Communication.

Dependent Variable	Independent Variable		
Linguistic Communication	Level FHI	OR	CI
Problems being understood	Mild FHI	1.30	(1.02 - 1.66)
	Moderate/Severe	1.31	(.90 - 1.91)
Problems understanding others	Mild FHI	2.08	(1.81 - 2.39)
	Moderate/Severe	3.31	(3.17 - 4.59)
Both	Mild FHI	2.74	(2.41 - 3.12)
	Moderate/Severe	3.96	(3.31 - 4.75)

Note 1. Delirium, cognition, and diagnosis of dementia were used as control variables in the multinomial logistic regression.

Note 2. The reference odds ratio for normal FHI is 1.0.

Note 3. The reference groups were residents with normal linguistic communication and without FHI.

Hearing Aid Use

Multinomial logistic regression was used to predict hearing aid use from FHI. FHI was the independent variable and hearing aid usage was the dependent variable. The findings showed that FHI could predict hearing aid use (Table 11). Residents with FHI were more likely to wear a hearing aid than residents who suffered no FHI.

Table 11. FHI as a predictor of hearing aid use.

Dependent Variable	Independent Variable (Predicted)		
Hearing aid Use	Level of FHI	OR	CI
	Mild FHI	6.19	(5.38 - 7.12)
	Moderate/severe	18.38	(15.84 - 21.33)

Note 1. The reference odds ratio for normal FHI is 1.0.

Note 2. The reference group were residents who did not use a hearing aid and without FHI.

Depression

Multinomial logistic regression was used to predict levels of depression from FHI. The independent variable was FHI and the dependent variable was the MDS DRS. The control variables

were delirium, cognition, diagnosis of dementia, and activities of daily living.

Higher levels of FHI were associated with a greater likelihood of experiencing symptoms of depression (see Table 12) as illustrated in Figure 8.

A further analysis examined the prediction of depression by hearing aid use. The findings showed that fewer residents who used a hearing aid experienced depression (see Table 13).

Table 12. Level of FHI as a predictor of symptoms of depression.

Dependent Variable	Independent Variable		
Symptoms of depression	Level of FHI	OR	CI
Mild	Mild	1.33	(1.18 - 1.51)
	Moderate/severe	1.71	(1.46 - 2.02)
Moderate/severe	Mild	1.37	(1.16 - 1.62)
	Moderate/severe	1.92	(1.54 - 2.38)

Note 1. Delirium, cognition, diagnosis of dementia, and activities of daily living were used as control variables in the Multinomial Logistic Regression.

Note 2. The reference odds ratio for normal FHI is 1.0.

Note 3. The reference group were residents without depression or FHI.

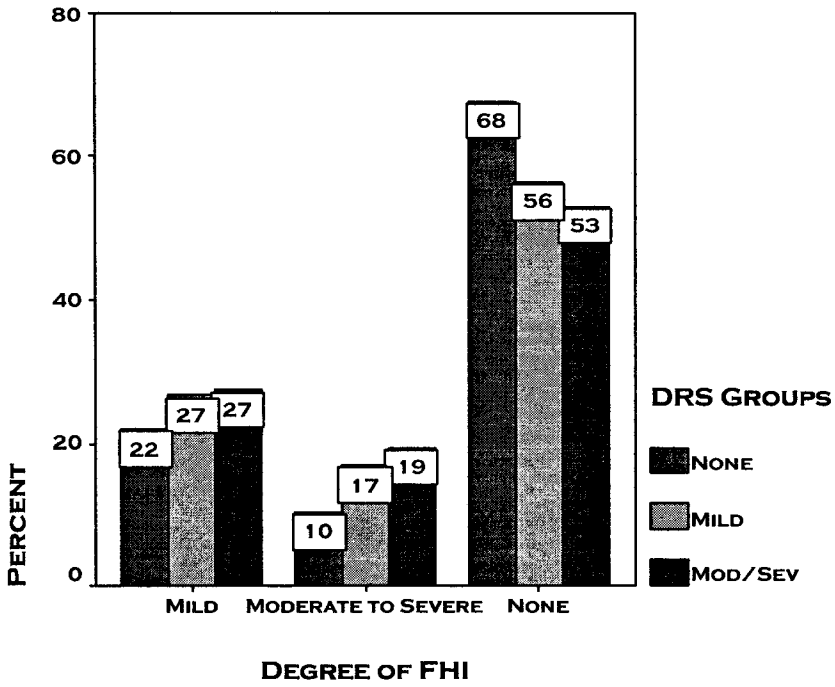

Figure 8. Percentage of residents in each of the FHI groups delineated by severity of depression measured by the DRS.

Table 13. Use of a hearing aid as a predictor of symptoms of depression.

Dependent Variable	Independent Variable		
Hearing Aid Used	Symptoms of depression	OR	CI
	Mild	.82	(0.70 - .98)
	Moderate/severe	.72	(0.57 - .91)

Note 1. Delirium, cognition, diagnosis of dementia, and activities of daily living were used as control variables in the Multinomial Logistic Regression.

Note 2. The reference odds ratio for no hearing aid is 1.0.

Note 3. The reference group were residents without depression who did not use a hearing aid.

Social Isolation

Anhedonia. Logistic regression analysis determined the relationship between FHI and anhedonia. FHI was the independent variable and anhedonia was the dependent variable. Delirium, cognition, diagnosis of dementia, and activities of daily living were used a control variables.

Residents with FHI were more likely to experience anhedonia compared to the reference group (Table 14). In addition, the likelihood of experiencing anhedonia was higher

for residents with more severe FHI. Twenty-eight percent (*sd* = .45) of the non-FHI group experienced symptoms of anhedonia compared to 35% (*sd* = .45) of residents with mild FHI and 43% (*sd* = .50) of residents with moderate/severe FHI.

Table 14. Level of FHI as a predictor of anhedonia.

Dependent Variable	Independent Variable		
Anhedonia	Level of FHI	OR	CI
	Mild	1.14	(1.03 - 1.26)
	Moderate/severe	1.34	(1.19 - 1.52)

Note 1. Delirium, cognition, diagnosis of dementia, and activities of daily living were used as control variables in the Multinomial Logistic Regression.

Note 2. The reference odds ratio for normal FHI is 1.0.

Note 3. The reference groups were residents without anhedonia or FHI.

Social Engagement. A multinomial logistic regression analysis determined the relationship between FHI and social engagement. Social engagement was the dependent variable, FHI the independent variable, and three measures of cognition

(delirium, cognition, diagnosis of dementia) and activities of daily living were the control variables.

Residents with Mild FHI were not significantly different from those without FHI; however, significantly fewer residents with moderate/severe FHI were socially engaged compared to the reference group (Table 15). The group with no FHI was more social (80%, *sd* = .40) than the group with moderate/severe FHI (65%, *sd* = .48; see Figure 9 for percentage of residents who were socially engaged).

Table 15. Level of FHI as a predictor of social engagement.

Dependent Variable	Independent Variable		
Low Social engagement	Level of FHI	OR	CI
	Mild	1.08	(0.97 - 1.22)
	Moderate/severe	1.23	(1.07 - 1.42)

Note 1. Delirium, cognition, diagnosis of dementia, and activities of daily living were used as control variables in the Multinomial Logistic Regression.

Note 2. The reference odds ratio for normal FHI is 1.0.

Note 3. The reference group were residents who were socially engaged and without FHI.

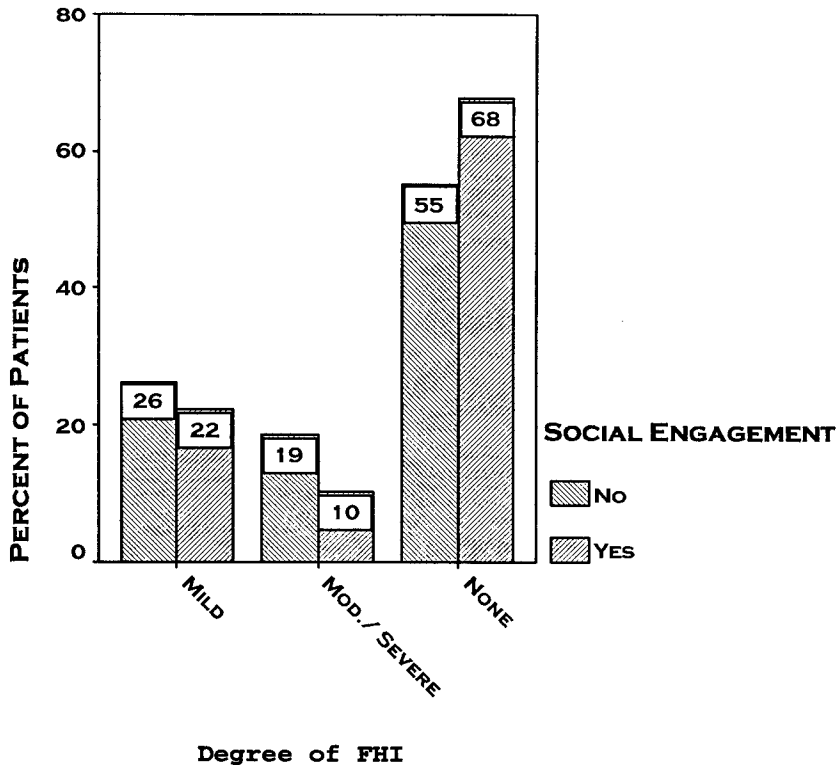

Figure 9. Social engagement as a function of FHI.

Activity level. To examine the differences among the groups, FHI was the independent variable and activity level was the dependent variable. Measures of cognition and activities of daily living were included as control variables.

The amount of time residents were involved in activities was significantly different for residents with moderate/severe FHI (Table 16). Figure 10 shows that significantly fewer residents with moderate/severe FHI engaged in activity for more than 2/3 of the time compared to residents with no FHI or mild FHI.

Table 16. Level of FHI as a predictor of Activity Level.

Dependent Variable	Independent Variable		
Low Activity level	Level of FHI	OR	CI
	Mild	0.98	(0.87 - 1.10)
	Moderate/severe	1.24	(1.04 - 1.48)

Note 1. Delirium, cognition, diagnosis of dementia, and activities of daily living were used as control variables in the Multinomial Logistic Regression.

Note 2. The reference odds ratio for normal FHI is 1.0.

Note 3. The reference group were active residents without FHI.

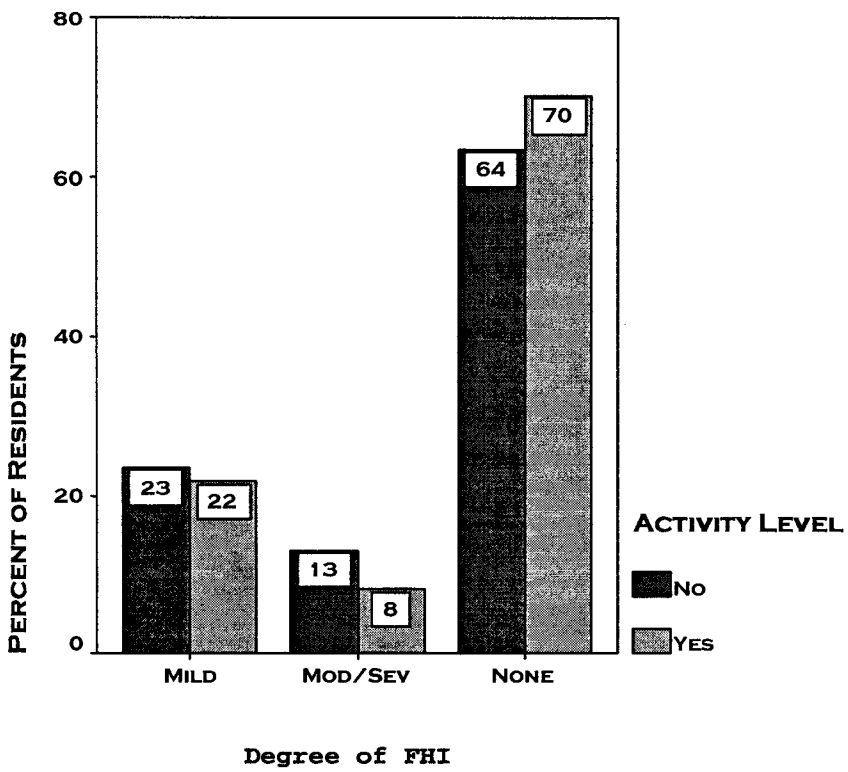

Figure 10. Activity level as a function of FHI.

Supplementary Analyses

Whereas the main analyses examined the independent relationships of linguistic communication, depression, and activity measures with FHI, after controlling for cognitive and physical functions, the supplementary analyses used path analysis with latent variables to test a model of the composite relationships. Because this statistical procedure (i.e., LISREL 7; Jörkeskog & Sörbom, 1989) requires the use of continuous measures, the analyses included only those variables measured at least on an ordinal scale. All the scores were converted to

standard scores to facilitate the interpretation of findings, with higher scores associated with the less favorable pole.

The independent variables in the model were FHI, the Lawton measure of cognition, the total score on the delirium items, and the total score on activities of daily living. The dependent variables were three latent variable consisting of the two linguistic communication items, activity (i.e., activity level and social engagement), and mood (i.e., the MDS DRS and anhedonia).[1] The model allowed free linkages from each independent variable to all three latent variables. Free linkages among the latent variables were from linguistic communication to activity and mood, and from activity to mood. A random split of the sample into two equally sized groups enabled a preliminary evaluation and fine-tuning of the model with one subsample, followed by confirmatory testing with the second sample.

The left-side column of Table 17 shows the goodness of fit of the model. The first two rows give the coefficients of determination for the dependent variables and the all the structural equations jointly were .996 and .778 on a scale from zero to one. Clearly, these statistics indicate good fit. The third row gives the value of Chi-square relative to its degrees

[1] Although anhedonia was considered a measure of social isolation in the main analyses, it was aligned with mood in the initial model because of a higher correlation with the MDS DRS than with either of the activity measures. There are strong reasons within both psychology and psychiatry to consider anhedonia an aspect of mood.

of freedom. Although lower values of Chi-square relative to the degrees of freedom indicate better fit, Jörkeskog and Sörbom (1989) point out limitations to the statistic in that a large sample size and departures from normality inflate the value over and above that expected from error specification in the model. The fourth and fifth rows contain the Goodness of Fit Index and the same index adjusted for degrees of freedom. Because these indexes have values between zero and one, the values in Table 17 suggest very good fit. Finally, the Root Mean Squared Residual in the sixth row (i.e., .022) is low for standardized variables, which again indicates good fit.

Table 17. Goodness of Fit Statistics for Initial and Final Models using Two Subsamples

Goodness of Fit Statistics	**Initial Model Subsample 1**	**Final Model Subsample 2**
Total Coefficient of Determination for Dependent Variables	.966	.974
Total Coefficient of Determination for Structural Equations	.778	.784
Chi-Square	302.16 (df=18)	146.34 (df=17)
Goodness of Fit	.990	.995
Adjusted Goodness of Fit	.971	.984
Root Mean Squared Residual	.022	.012

Although all statistics bar Chi-Square indicated very good fit, use of Modification Indexes indicated that Chi-Square would reduce by 152 after freeing the linkage from the activity latent variable to the anhedonia measure. This modification appears reasonable given that the item content refers to activity even though the scale also relates to mood. After

making this modification, use of the Modification Indexes showed no further sources of substantial improvement to the model.

Use of the revised model with the second subsample indicated very good fit, as shown in the right-side column of Table 17. The value of Chi-square was appreciably lower in second subsample, probably because of the modification to the model, with all the other statistics indicating fractionally better fit.

Table 18 gives the values of coefficients in the Gamma and Beta matrices for the final model. The Gamma matrix includes linkages from the independent variables to the dependent latent variables. The Beta matrix includes within the dependent latent variables. The coefficients associated with all the other matrices are in the Appendices.

Table 18. Gamma and Beta Matrices for the Final Model with the Second Subsample.

Matrix	Dependent Variables	Predictor Variables			
Gamma		Lawton	Delirium	ADL	FHI
	Communication	.415	.168	.126	.087
	Activity	.300	.072	.300	(.002)*
	Mood	-.176	.417	-.068	.054
Beta		Communication		Activity	
	Activity	.084			
	Mood	(.037)*		.259	

* Nonsignificant *t* value for coefficient.

It is not surprising that most coefficients differed significantly from zero, given the large size of the subsample. The only coefficients with nonsignificant values indicate an absence of direct linkages from FHI to activity and from linguistic communication to mood. The significant coefficients in the Gamma matrix indicate that

- Poor cognition (i.e., the Lawton) and impaired activities of daily living have adverse effects on linguistic communication and activity, but that residents with more favorable levels were those with poor mood;

- Delirium has adverse effects on all the dependent latent variables;
- FHI has adverse effects on linguistic communication and mood.

The significant coefficients in the Beta matrix indicate that linguistic communication affects activity and activity affects mood.

Discussion

Presbycusis is an age related hearing loss. It describes a gradual decrease in hearing ability that is associated with age. Presbycusis raises the *hearing threshold*, the point at which one can functionally hear. A higher hearing threshold makes the ability to hear more difficult.

A large number of older people experience presbycusis. Hearing aids often improve hearing loss (Lamden, Leger, and Raveglia, 1992; Mulrow, Tuley, and Aguilar, 1992). However, for a number of reasons many older people refuse to wear their hearing aid (Wilson, Fleming and Donaldson, 1993), and others may derive little or no benefit from their hearing device. With respect to the measurement of hearing disorder, pure tone hearing screening may not be as well suited for the elderly as it is for younger age groups. A questionnaire measuring FHI may be better suited for the elderly.

Identifying hearing impairment is important because of the possible negative outcomes associated with hearing impairment. Previous research using pure tone hearing assessment was inconsistent in establishing a association between hearing impairment, depression, and social isolation. The purpose of this study was to determine if FHI, measured by the MDS, is associated with increased symptoms of depression and social isolation (anhedonia, reduced social engagement, and decreased levels of activity) in elderly complex continuing care residents in Ontario.

The MDS uses qualitative measures to determine hearing loss. In fact, the MDS Communication/Hearing Patterns index identifies 4 levels of hearing impairment. As stated earlier, this form of measurement may provide a more sensitive appraisal of hearing loss compared to traditional pure-tone hearing test.

The present research studied the effects of hearing loss on depression and social isolation after controlling for measures of cognitive and physical function. The strengths of the design include the large sample size and a comprehensive array of reliable measures. Limitations include the cross-sectional nature of the data, with 'causal' inferences inferred through correlations or their equivalent, and issues about the generality of the findings beyond the confines of Ontario complex continuing care facilities.

The hypotheses in the present research were based on findings by Hopper et al. (2001) who showed that measures from the MDS were able to discriminate between those with and without adequate hearing in participants who were unable to succeed on a pure tone screening test.

The present findings showed that the MDS FHI measure was able to discriminate between linguistic communication scores. Residents with FHI were more likely to record lower scores of linguistic communication compared to residents with normal hearing. This was true even after removing the effects of cognition (poor cognition, delirium, and dementia). Consequently, the present findings replicate those by Hopper et al. (2001).

A principle concern of this study was the association between FHI and depression. Analysis showed an association between depression and FHI. Residents who were hearing impaired were more likely to experience symptoms of depression, with the severity of FHI associated with more severe symptoms of depression. These findings replicate findings from some previous studies that measured hearing loss with pure tone hearing tests (Cacciatore et al., 1999; Kalayam et al., 1995).

In addition to symptoms of depression, the author examined three measures of social isolation (anhedonia, social engagement, and activity level). Although anhedonia is also an

aspect of mood, the symptoms include a withdrawal from social engagement.

The results showed that individuals with FHI had higher levels of anhedonia. Residents with moderate/severe FHI also had lower social engagement scores and lower levels activity.

A model explored in the supplementary analyses suggests that hearing impairment affects mood through the following sequence:

- Hearing impairment impairs linguistic communication;
- Impaired linguistic communication results in social isolation;
- Social isolation lowers mood.

The models tested provided a good fit to the data, with findings that support this sequence but also show a direct effect of hearing impairment on mood. Poor mood include both dysphoria (measured by the DRS) and anhedonia, with the reasons for the direct effects of hearing impairment unclear.

Implications of the findings extend to the possible benefits of aggressive hearing improvement programs for the elder. Simply improving the ability to hear and communicate more effectively may reduce errors and facilitate the effectiveness in other treatment regimens. It is also possible, based on the present findings, that hearing improvement programs may enhance mood either directly or indirectly through

a communication→activity→mood sequence. Unfortunately, geriatric hearing improvement programs appear to be of low priority in complex continuing care as indicated by the low number of hearing impaired residents that receive such intervention.

To conclude this thesis, there is a relative absence of research on the relationships between different measures of hearing impairment. Only one study that focused primarily on residents with dementia compared the MDS FHI measure with other measures. The next step in this line of research would be to validate FHI scores against traditional methods of hearing assessment and in other populations. It may be important to re-examine the usefulness of pure tone screening tests in the frail elderly or to adjust scores to provide an appropriate baseline. This may allow the door to open for future research in FHI.

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Appendix A. Minimum Data Set 2.0

Resident _____ Numeric Identifier _____

MINIMUM DATA SET (MDS) — *VERSION 2.0*
FOR NURSING HOME RESIDENT ASSESSMENT AND CARE SCREENING
FULL ASSESSMENT FORM
(Status in last 7 days, unless other time frame indicated)

SECTION A. IDENTIFICATION AND BACKGROUND INFORMATION

1.	RESIDENT NAME	a. (First) b. (Middle Initial) c. (Last) d. (Jr/Sr)
2.	ROOM NUMBER	
3.	ASSESSMENT REFERENCE DATE	a. *Last day of MDS observation period* Month Day Year b. Original (0) or corrected copy of form (enter number of correction)
4a.	DATE OF REENTRY	Date of reentry from most recent temporary discharge to a hospital in last 90 days (or since last assessment or admission if less than 90 days) Month Day Year
5.	MARITAL STATUS	1. Never married 3. Widowed 5. Divorced 2. Married 4. Separated
6.	MEDICAL RECORD NO.	
7.	CURRENT PAYMENT SOURCES FOR N.H. STAY	(*Billing Office to indicate; check all that apply in last 30 days*) Medicaid per diem a. — VA per diem t. Medicare per diem b. — Self or family pays for full per diem g. Medicare ancillary part A c. — Medicaid resident liability or Medicare co-payment h. Medicare ancillary part B d. — Private insurance per diem (including co-payment) i. CHAMPUS per diem e. — Other per diem j.
8.	REASONS FOR ASSESSMENT *[Note—If this is a discharge or reentry assessment, only a limited subset of MDS items need be completed]*	a. Primary reason for assessment 1. Admission assessment (required by day 14) 2. Annual assessment 3. Significant change in status assessment 4. Significant correction of prior full assessment 5. Quarterly review assessment 6. Discharges—return not anticipated 7. Discharged—return anticipated 8. Discharged prior to completing initial assessment 9. Reentry 10. Significant correction of prior quarterly assessment 0. *NONE OF ABOVE* b. ***Codes for assessments required for Medicare PPS or the State*** 1. *Medicare 5 day assessment* 2. *Medicare 30 day assessment* 3. *Medicare 60 day assessment* 4. *Medicare 90 day assessment* 5. *Medicare readmission/return assessment* 6. *Other state required assessment* 7. *Medicare 14 day assessment* 8. *Other Medicare required assessment*
9.	RESPONSIBILITY/ LEGAL GUARDIAN	(*Check all that apply*) Legal guardian a. — Durable power attorney/financial d. Other legal oversight b. — Family member responsible e. Durable power of attorney/health care c. — Patient responsible for self f. *NONE OF ABOVE* g.
10.	ADVANCED DIRECTIVES	(*For those items with supporting documentation in the medical record, check all that apply*) Living will a. — Feeding restrictions f. Do not resuscitate b. — Medication restrictions g. Do not hospitalize c. — Other treatment restrictions h. Organ donation d. — *NONE OF ABOVE* i. Autopsy request e.

SECTION B. COGNITIVE PATTERNS

1.	COMATOSE	(*Persistent vegetative state/no discernible consciousness*) 0. No 1. Yes (*If yes, skip to Section G*)
2.	MEMORY	(*Recall of what was learned or known*) a. Short-term memory OK—seems/appears to recall after 5 minutes 0. Memory OK 1. Memory problem b. Long-term memory OK—seems/appears to recall long past 0. Memory OK 1. Memory problem
3.	MEMORY/ RECALL ABILITY	(*Check all that resident was normally able to recall during last 7 days*) Current season a. — That he/she is in a nursing home d. Location of own room b. — *NONE OF ABOVE* are recalled e. Staff names/faces c.
4.	COGNITIVE SKILLS FOR DAILY DECISION-MAKING	(*Made decisions regarding tasks of daily life*) 0. *INDEPENDENT*—decisions consistent/reasonable 1. *MODIFIED INDEPENDENCE*—some difficulty in new situations only 2. *MODERATELY IMPAIRED*—decisions poor; cues/supervision required 3. *SEVERELY IMPAIRED*—never/rarely made decisions
5.	INDICATORS OF DELIRIUM—PERIODIC DISORDERED THINKING/ AWARENESS	(*Code for behavior in the last 7 days.*) [*Note: Accurate assessment requires conversations with staff and family who have direct knowledge of resident's behavior over this time*]. 0. Behavior not present 1. Behavior present, not of recent onset 2. Behavior present, over last 7 days appears different from resident's usual functioning (e.g., new onset or worsening) a. EASILY DISTRACTED—(e.g., difficulty paying attention; gets sidetracked) b. PERIODS OF ALTERED PERCEPTION OR AWARENESS OF SURROUNDINGS—(e.g., moves lips or talks to someone not present; believes he/she is somewhere else; confuses night and day) c. EPISODES OF DISORGANIZED SPEECH—(e.g., speech is incoherent, nonsensical, irrelevant, or rambling from subject to subject; loses train of thought) d. PERIODS OF RESTLESSNESS—(e.g., fidgeting or picking at skin, clothing, napkins, etc; frequent position changes; repetitive physical movements or calling out) e. PERIODS OF LETHARGY—(e.g., sluggishness; staring into space; difficult to arouse; little body movement) f. MENTAL FUNCTION VARIES OVER THE COURSE OF THE DAY—(e.g., sometimes better, sometimes worse; behaviors sometimes present, sometimes not)
6.	CHANGE IN COGNITIVE STATUS	Resident's cognitive status, skills, or abilities have changed as compared to status of 90 days ago (or since last assessment if less than 90 days) 0. No change 1. Improved 2. Deteriorated

SECTION C. COMMUNICATION/HEARING PATTERNS

1.	HEARING	(*With hearing appliance, if used*) 0. *HEARS ADEQUATELY*—normal talk, TV, phone 1. *MINIMAL DIFFICULTY* when not in quiet setting 2. *HEARS IN SPECIAL SITUATIONS ONLY*—speaker has to adjust tonal quality and speak distinctly 3. *HIGHLY IMPAIRED*/absence of useful hearing
2.	COMMUNICATION DEVICES/ TECHNIQUES	(*Check all that apply during last 7 days*) Hearing aid, present and used a. Hearing aid, present and not used regularly b. Other receptive comm. techniques used (e.g., lip reading) c. *NONE OF ABOVE* d.
3.	MODES OF EXPRESSION	(*Check all used by resident to make needs known*) Speech a. — Signs/gestures/sounds d. Writing messages to express or clarify needs b. — Communication board e. American sign language or Braille c. — Other f. *NONE OF ABOVE* g.
4.	MAKING SELF UNDERSTOOD	(*Expressing information content—however able*) 0. *UNDERSTOOD* 1. *USUALLY UNDERSTOOD*—difficulty finding words or finishing thoughts 2. *SOMETIMES UNDERSTOOD*—ability is limited to making concrete requests 3. *RARELY/NEVER UNDERSTOOD*
5.	SPEECH CLARITY	(*Code for speech in the last 7 days*) 0. *CLEAR SPEECH*—distinct, intelligible words 1. *UNCLEAR SPEECH*—slurred, mumbled words 2. *NO SPEECH*—absence of spoken words
6.	ABILITY TO UNDERSTAND OTHERS	(*Understanding verbal and written content—however able*) 0. *UNDERSTANDS* 1. *USUALLY UNDERSTANDS*—may miss some part/intent of message 2. *SOMETIMES UNDERSTANDS*—responds adequately to simple, direct communication 3. *RARELY/NEVER UNDERSTANDS*
7.	CHANGE IN COMMUNICATION/ HEARING	Resident's ability to express, understand, or hear information has changed as compared to status of 90 days ago (or since last assessment if less than 90 days) 0. No change 1. Improved 2. Deteriorated

☐ = When box blank, must enter number or letter [a.] = When letter in box, check if condition applies

MDS 2.0 September, 2000

Resident _____ Numeric Identifier _____

SECTION D. VISION PATTERNS

1.	VISION	*(Ability to see in adequate light and with glasses if used)* 0. *ADEQUATE*—sees fine detail, including regular print in newspapers/books 1. *IMPAIRED*—sees large print, but not regular print in newspapers/books 2. *MODERATELY IMPAIRED*—limited vision; not able to see newspaper headlines, but can identify objects 3. *HIGHLY IMPAIRED*—object identification in question, but eyes appear to follow objects 4. *SEVERELY IMPAIRED*—no vision or sees only light, colors, or shapes; eyes do not appear to follow objects	
2.	VISUAL LIMITATIONS/ DIFFICULTIES	Side vision problems—decreased peripheral vision (e.g., leaves food on one side of tray, difficulty traveling, bumps into people and objects, misjudges placement of chair when seating self)	a.
		Experiences any of following: sees halos or rings around lights; sees flashes of light; sees "curtains" over eyes	b.
		NONE OF ABOVE	c.
3.	VISUAL APPLIANCES	Glasses; contact lenses; magnifying glass 0. No 1. Yes	

SECTION E. MOOD AND BEHAVIOR PATTERNS

1.	INDICATORS OF DEPRESSION, ANXIETY, SAD MOOD	*(Code for indicators observed in last 30 days, irrespective of the assumed cause)*: 0. indicator not exhibited in last 30 days 1. indicator of this type exhibited up to five days a week 2. indicator of this type exhibited daily or almost daily (6, 7 days a week)	
		VERBAL EXPRESSIONS OF DISTRESS	
		a. Resident made negative statements—e.g., *"Nothing matters; Would rather be dead; What's the use; Regrets having lived so long; Let me die"*	
		b. Repetitive questions—e.g., *"Where do I go; What do I do?"*	
		c. Repetitive verbalizations—e.g., calling out for help, *("God help me")*	
		d. Persistent anger with self or others—e.g., easily annoyed, anger at placement in nursing home; anger at care received	
		e. Self deprecation—e.g., *"I am nothing; I am of no use to anyone"*	
		f. Expressions of what appear to be unrealistic fears—e.g., fear of being abandoned, left alone, being with others	
		g. Recurrent statements that something terrible is about to happen—e.g., believes he or she is about to die, have a heart attack	
		h. Repetitive health complaints—e.g., persistently seeks medical attention, obsessive concern with body functions	
		i. Repetitive anxious complaints/concerns (non-health related) e.g., persistently seeks attention/ reassurance regarding schedules, meals, laundry, clothing, relationship issues	
		SLEEP-CYCLE ISSUES	
		j. Unpleasant mood in morning	
		k. Insomnia/change in usual sleep pattern	
		SAD, APATHETIC, ANXIOUS APPEARANCE	
		l. Sad, pained, worried facial expressions—e.g., furrowed brows	
		m. Crying, tearfulness	
		n. Repetitive physical movements—e.g., pacing, hand wringing, restlessness, fidgeting, picking	
		LOSS OF INTEREST	
		o. Withdrawal from activities of interest—e.g., no interest in long standing activities or being with family/friends	
		p. Reduced social interaction	
2.	MOOD PERSISTENCE	One or more indicators of depressed, sad or anxious mood were not easily altered by attempts to "cheer up", console, or reassure the resident over last 7 days 0. No mood indicators 1. indicators present, easily altered 2. Indicators present, not easily altered	
3.	CHANGE IN MOOD	Resident's mood status has changed as compared to status of 90 days ago (or since last assessment if less than 90 days) 0. No change 1. Improved 2. Deteriorated	
4.	BEHAVIORAL SYMPTOMS	(A) *Behavioral symptom frequency in last 7 days* 0. Behavior not exhibited in last 7 days 1. Behavior of this type occurred 1 to 3 days in last 7 days 2. Behavior of this type occurred 4 to 6 days, but less than daily 3. Behavior of this type occurred daily (B) *Behavioral symptom alterability in last 7 days* 0. Behavior not present OR behavior was easily altered 1. Behavior was not easily altered	(A) (B)
		a. WANDERING (moved with no rational purpose, seemingly oblivious to needs or safety)	
		b. VERBALLY ABUSIVE BEHAVIORAL SYMPTOMS (others were threatened, screamed at, cursed at)	
		c. PHYSICALLY ABUSIVE BEHAVIORAL SYMPTOMS (others were hit, shoved, scratched, sexually abused)	
		d. SOCIALLY INAPPROPRIATE/DISRUPTIVE BEHAVIORAL SYMPTOMS (made disruptive sounds, noisiness, screaming, self-abusive acts, sexual behavior or disrobing in public, smeared/threw food/feces, hoarding, rummaged through others' belongings)	
		e. RESISTS CARE (resisted taking medications/ injections, ADL assistance, or eating)	

5.	CHANGE IN BEHAVIORAL SYMPTOMS	Resident's behavior status has changed as compared to status of 90 days ago (or since last assessment if less than 90 days) 0. No change 1. Improved 2. Deteriorated	

SECTION F. PSYCHOSOCIAL WELL-BEING

1.	SENSE OF INITIATIVE/ INVOLVEMENT	At ease interacting with others	a.
		At ease doing planned or structured activities	b.
		At ease doing self-initiated activities	c.
		Establishes own goals	d.
		Pursues involvement in life of facility (e.g., makes/keeps friends; involved in group activities; responds positively to new activities; assists at religious services)	e.
		Accepts invitations into most group activities	f.
		NONE OF ABOVE	g.
2.	UNSETTLED RELATIONSHIPS	Overt/open conflict with or repeated criticism of staff	a.
		Unhappy with roommate	b.
		Unhappy with residents other than roommate	c.
		Openly expresses conflict/anger with family/friends	d.
		Absence of personal contact with family/friends	e.
		Recent loss of close family member/friend	f.
		Does not adjust easily to change in routines	g.
		NONE OF ABOVE	h.
3.	PAST ROLES	Strong identification with past roles and life status	a.
		Expresses sadness/anger/empty feeling over lost roles/status	b.
		Resident perceives that daily routine (customary routine, activities) is very different from prior pattern in the community	c.
		NONE OF ABOVE	d.

SECTION G. PHYSICAL FUNCTIONING AND STRUCTURAL PROBLEMS

1. (A) ADL SELF-PERFORMANCE—*(Code for resident's PERFORMANCE OVER ALL SHIFTS during last 7 days—Not including setup)*
   - 0. *INDEPENDENT*—No help or oversight —OR— Help/oversight provided only 1 or 2 times during last 7 days
   - 1. *SUPERVISION*—Oversight, encouragement or cueing provided 3 or more times during last 7 days —OR— Supervision (3 or more times) plus physical assistance provided only 1 or 2 times during last 7 days
   - 2. *LIMITED ASSISTANCE*—Resident highly involved in activity; received physical help in guided maneuvering of limbs or other hor/weight bearing assistance 3 or more times —OR—More help provided only 1 or 2 times during last 7 days
   - 3. *EXTENSIVE ASSISTANCE*—While resident performed part of activity, over last 7-day period, help of following type(s) provided 3 or more times:
     —Weight-bearing support
     — Full staff performance during part (but not all) of last 7 days
   - 4. *TOTAL DEPENDENCE*—Full staff performance of activity during entire 7 days
   - 8. *ACTIVITY DID NOT OCCUR* during entire 7 days

   (B) ADL SUPPORT PROVIDED—*(Code for MOST SUPPORT PROVIDED OVER ALL SHIFTS during last 7 days; code regardless of resident's self-performance classification)*
   - 0. No setup or physical help from staff
   - 1. Setup help only
   - 2. One person physical assist
   - 3. Two+ persons physical assist
   - 8. ADL activity itself did not occur during entire 7 days

			(A) SELF-PERF	(B) SUPPORT
a.	BED MOBILITY	How resident moves to and from lying position, turns side to side, and positions body while in bed		
b.	TRANSFER	How resident moves between surfaces—to/from: bed, chair, wheelchair, standing position (EXCLUDE to/from bath/toilet)		
c.	WALK IN ROOM	How resident walks between locations in his/her room		
d.	WALK IN CORRIDOR	How resident walks in corridor on unit		
e.	LOCOMOTION ON UNIT	How resident moves between locations in his/her room and adjacent corridor on same floor. If in wheelchair, self-sufficiency once in chair		
f.	LOCOMOTION OFF UNIT	How resident moves to and returns from off unit locations (e.g., areas set aside for dining, activities, or treatments). If facility has only one floor, how resident moves to and from distant areas on the floor. If in wheelchair, self-sufficiency once in chair		
g.	DRESSING	How resident puts on, fastens, and takes off all items of street clothing, including donning/removing prostheses		
h.	EATING	How resident eats and drinks (regardless of skill). Includes intake of nourishment by other means (e.g., tube feeding, total parenteral nutrition)		
i.	TOILET USE	How resident uses the toilet room (or commode, bedpan, urinal); transfer on/off toilet, cleanses, changes pad; manages ostomy or catheter; adjusts clothes		
j.	PERSONAL HYGIENE	How resident maintains personal hygiene, including combing hair, brushing teeth, shaving, applying makeup, washing/drying face, hands, and perineum (EXCLUDE baths and showers)		

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2.	BATHING	How resident takes full-body bath/shower, sponge bath, and transfers in/out of tub/shower (EXCLUDE washing of back and hair.) *Code for most dependent in self-performance and support.* (A) BATHING SELF-PERFORMANCE codes appear below	(A)	(B)
		0. Independent—No help provided		
		1. Supervision—Oversight help only		
		2. Physical help limited to transfer only		
		3. Physical help in part of bathing activity		
		4. Total dependence		
		8. Activity itself did not occur during entire 7 days *(Bathing support codes are as defined in item 1, code B above)*		
3.	TEST FOR BALANCE (see training manual)	*(Code for ability during test in the last 7 days)* 0. Maintained position as required in test 1. Unsteady, but able to rebalance self without physical support 2. Partial physical support during test; or stands (sits) but does not follow directions for test 3. Not able to attempt test without physical help		
		a. Balance while standing		
		b. Balance while sitting—position, trunk control		
4.	FUNCTIONAL LIMITATION IN RANGE OF MOTION (see training manual)	*(Code for limitations during last 7 days that interfered with daily functions or placed resident at risk of injury)* (A) *RANGE OF MOTION*: 0. No limitation; 1. Limitation on one side; 2. Limitation on both sides (B) *VOLUNTARY MOVEMENT*: 0. No loss; 1. Partial loss; 2. Full loss	(A)	(B)
		a. Neck		
		b. Arm—including shoulder or elbow		
		c. Hand—including wrist or fingers		
		d. Leg—including hip or knee		
		e. Foot—including ankle or toes		
		f. Other limitation or loss		
5.	MODES OF LOCOMOTION	*(Check all that apply during last 7 days)*		
		Cane/walker/crutch — a.	Wheelchair primary mode of locomotion — d.	
		Wheeled self — b.		
		Other person wheeled — c.	*NONE OF ABOVE* — e.	
6.	MODES OF TRANSFER	*(Check all that apply during last 7 days)*		
		Bed-fast all or most of time — a.	Lifted mechanically — d.	
		Bed rails used for bed mobility or transfer — b.	Transfer aid (e.g., slide board, trapeze, cane, walker, brace) — e.	
		Lifted manually — c.	*NONE OF ABOVE* — f.	
7.	TASK SEGMENTATION	Some or all of ADL activities were broken into subtasks during last 7 days so that resident could perform them 0. No 1. Yes		
8.	ADL FUNCTIONAL REHABILITATION POTENTIAL	Resident believes he/she is capable of increased independence in at least some ADLs		a.
		Direct care staff believe resident is capable of increased independence in at least some ADLs		b.
		Resident able to perform tasks/activity but is very slow		c.
		Difference in ADL Self-Performance or ADL Support, comparing mornings to evenings		d.
		NONE OF ABOVE		e.
9.	CHANGE IN ADL FUNCTION	Resident's ADL self-performance status has changed as compared to status of **90 days ago** (or since last assessment if less than 90 days) 0. No change 1. Improved 2. Deteriorated		

SECTION H. CONTINENCE IN LAST 14 DAYS

1.	CONTINENCE SELF-CONTROL CATEGORIES *(Code for resident's PERFORMANCE OVER ALL SHIFTS)* 0. *CONTINENT*—Complete control (includes use of indwelling urinary catheter or ostomy device that does not leak urine or stool) 1. *USUALLY CONTINENT*—BLADDER, incontinent episodes once a week or less; BOWEL, less than weekly 2. *OCCASIONALLY INCONTINENT*—BLADDER, 2 or more times a week but not daily; BOWEL, once a week 3. *FREQUENTLY INCONTINENT*—BLADDER, tended to be incontinent daily, but some control present (e.g., on day shift); BOWEL, 2-3 times a week 4. *INCONTINENT*—Had inadequate control BLADDER, multiple daily episodes; BOWEL, all (or almost all) of the time			
a.	BOWEL CONTINENCE	Control of bowel movement, with appliance or bowel continence programs, if employed		
b.	BLADDER CONTINENCE	Control of urinary bladder function (if dribbles, volume insufficient to soak through underpants), with appliances (e.g., foley) or continence programs, if employed		
2.	BOWEL ELIMINATION PATTERN	Bowel elimination pattern regular—at least one movement every three days	a.	Diarrhea — c.
				Fecal impaction — d.
		Constipation	b.	*NONE OF ABOVE* — e.

3.	APPLIANCES AND PROGRAMS	Any scheduled toileting plan	a.	Did not use toilet room/commode/urinal — f.
		Bladder retraining program	b.	Pads/briefs used — g.
		External (condom) catheter	c.	Enemas/irrigation — h.
		Indwelling catheter	d.	Ostomy present — i.
		Intermittent catheter	e.	*NONE OF ABOVE* — j.
4.	CHANGE IN URINARY CONTINENCE	Resident's urinary continence has changed as compared to status of **90 days ago** (or since last assessment if less than 90 days) 0. No change 1. Improved 2. Deteriorated		

SECTION I. DISEASE DIAGNOSES

Check only those diseases that have a relationship to current ADL status, cognitive status, mood and behavior status, medical treatments, nursing monitoring, or risk of death. (Do not list inactive diagnoses)

1.	DISEASES	*(If none apply, CHECK the NONE OF ABOVE box)*		
		ENDOCRINE/METABOLIC/NUTRITIONAL		Hemiplegia/hemiparesis — v.
		Diabetes mellitus	a.	Multiple sclerosis — w.
		Hyperthyroidism	b.	Paraplegia — x.
		Hypothyroidism	c.	Parkinson's disease — y.
		HEART/CIRCULATION		Quadriplegia — z.
		Arteriosclerotic heart disease (ASHD)	d.	Seizure disorder — aa.
		Cardiac dysrhythmias	e.	Transient ischemic attack (TIA) — bb.
		Congestive heart failure	f.	Traumatic brain injury — cc.
		Deep vein thrombosis	g.	PSYCHIATRIC/MOOD —
		Hypertension	h.	Anxiety disorder — dd.
		Hypotension	i.	Depression — ee.
		Peripheral vascular disease	j.	Manic depression (bipolar disease) — ff.
		Other cardiovascular disease	k.	Schizophrenia — gg.
		MUSCULOSKELETAL		PULMONARY —
		Arthritis	l.	Asthma — hh.
		Hip fracture	m.	Emphysema/COPD — ii.
		Missing limb (e.g., amputation)	n.	SENSORY —
		Osteoporosis	o.	Cataracts — jj.
		Pathological bone fracture	p.	Diabetic retinopathy — kk.
		NEUROLOGICAL		Glaucoma — ll.
		Alzheimer's disease	q.	Macular degeneration — mm.
		Aphasia	r.	OTHER —
		Cerebral palsy	s.	Allergies — nn.
		Cerebrovascular accident (stroke)	t.	Anemia — oo.
		Dementia other than Alzheimer's disease	u.	Cancer — pp.
				Renal failure — qq.
				NONE OF ABOVE — rr.
2.	INFECTIONS	*(If none apply, CHECK the NONE OF ABOVE box)*		
		Antibiotic resistant infection (e.g., Methicillin resistant staph)	a.	Septicemia — g.
		Clostridium difficile (c. diff.)	b.	Sexually transmitted diseases — h.
		Conjunctivitis	c.	Tuberculosis — i.
		HIV infection	d.	Urinary tract infection in last 30 days — j.
		Pneumonia	e.	Viral hepatitis — k.
		Respiratory infection	f.	Wound infection — l.
				NONE OF ABOVE — m.
3.	OTHER CURRENT OR MORE DETAILED DIAGNOSES AND ICD-9 CODES	a. _____		
		b. _____		
		c. _____		
		d. _____		
		e. _____		

SECTION J. HEALTH CONDITIONS

1.	PROBLEM CONDITIONS	*(Check all problems present in last 7 days unless other time frame is indicated)*		
		INDICATORS OF FLUID STATUS		Dizziness/Vertigo — f.
				Edema — g.
		Weight gain or loss of 3 or more pounds within a 7 day period		Fever — h.
			a.	Hallucinations — i.
		Inability to lie flat due to shortness of breath		Internal bleeding — j.
			b.	Recurrent lung aspirations in last 90 days — k.
		Dehydrated; output exceeds input		Shortness of breath — l.
			c.	Syncope (fainting) — m.
		Insufficient fluid; did NOT consume all/almost all liquids provided during last 3 days		Unsteady gait — n.
			d.	Vomiting — o.
		OTHER		*NONE OF ABOVE* — p.
		Delusions	e.	

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2.	PAIN SYMPTOMS	*(Code the highest level of pain present in the last 7 days)* a. FREQUENCY with which resident complains or shows evidence of pain 0. No pain *(skip to J4)* 1. Pain less than daily 2. Pain daily b. INTENSITY of pain 1. Mild pain 2. Moderate pain 3. Times when pain is horrible or excruciating	
3.	PAIN SITE	*(If pain present, check all sites that apply in last 7 days)* Back pain [a.] Bone pain [b.] Chest pain while doing usual activities [c.] Headache [d.] Hip pain [e.] Incisional pain [f.] Joint pain (other than hip) [g.] Soft tissue pain (e.g., lesion, muscle) [h.] Stomach pain [i.] Other [j.]	
4.	ACCIDENTS	*(Check all that apply)* Fell in past 30 days [a.] Fell in past 31-180 days [b.] Hip fracture in last 180 days [c.] Other fracture in last 180 days [d.] NONE OF ABOVE [e.]	
5.	STABILITY OF CONDITIONS	Conditions/diseases make resident's cognitive, ADL, mood or behavior patterns unstable—(fluctuating, precarious, or deteriorating) [a.] Resident experiencing an acute episode or a flare-up of a recurrent or chronic problem [b.] End-stage disease, 6 or fewer months to live [c.] NONE OF ABOVE [d.]	

SECTION K. ORAL/NUTRITIONAL STATUS

1.	ORAL PROBLEMS	Chewing problem [a.] Swallowing problem [b.] Mouth pain [c.] NONE OF ABOVE [d.]	
2.	HEIGHT AND WEIGHT	*Record (a.) height in inches and (b.) weight in pounds. Base weight on most recent measure in last 30 days; measure weight consistently in accord with standard facility practice—e.g., in a.m. after voiding, before meal, with shoes off, and in nightclothes* a. Ht (in.) b. Wt (lb.)	
3.	WEIGHT CHANGE	a. Weight loss—5 % or more in last 30 days; or 10 % or more in last 180 days 0. No 1. Yes b. Weight gain—5 % or more in last 30 days; or 10 % or more in last 180 days 0. No 1. Yes	
4.	NUTRITIONAL PROBLEMS	Complains about the taste of many foods [a.] Regular or repetitive complaints of hunger [b.] Leaves 25% or more of food uneaten at most meals [c.] NONE OF ABOVE [d.]	
5.	NUTRITIONAL APPROACHES	*(Check all that apply in last 7 days)* Parenteral/IV [a.] Feeding tube [b.] Mechanically altered diet [c.] Syringe (oral feeding) [d.] Therapeutic diet [e.] Dietary supplement between meals [f.] Plate guard, stabilized built-up utensil, etc. [g.] On a planned weight change program [h.] NONE OF ABOVE [i.]	
6.	PARENTERAL OR ENTERAL INTAKE	*(Skip to Section L if neither 5a nor 5b is checked)* a. Code the proportion of total calories the resident received through parenteral or tube feedings in the last 7 days 0. None 3. 51% to 75% 1. 1% to 25% 4. 76% to 100% 2. 26% to 50% b. Code the average fluid intake per day by IV or tube in last 7 days 0. None 3. 1001 to 1500 cc/day 1. 1 to 500 cc/day 4. 1501 to 2000 cc/day 2. 501 to 1000 cc/day 5. 2001 or more cc/day	

SECTION L. ORAL/DENTAL STATUS

1.	ORAL STATUS AND DISEASE PREVENTION	Debris (soft, easily movable substances) present in mouth prior to going to bed at night [a.] Has dentures or removable bridge [b.] Some/all natural teeth lost—does not have or does not use dentures (or partial plates) [c.] Broken, loose, or carious teeth [d.] Inflamed gums (gingiva); swollen or bleeding gums; oral abscesses; ulcers or rashes [e.] Daily cleaning of teeth/dentures or daily mouth care—by resident or staff [f.] NONE OF ABOVE [g.]	

SECTION M. SKIN CONDITION

			Number at Stage
1.	ULCERS (Due to any cause)	*(Record the number of ulcers at each ulcer stage—regardless of cause. If none present at a stage, record "0" (zero). Code all that apply during last 7 days. Code 9 = 9 or more.) [Requires full body exam.]* a. Stage 1. A persistent area of skin redness (without a break in the skin) that does not disappear when pressure is relieved. b. Stage 2. A partial thickness loss of skin layers that presents clinically as an abrasion, blister, or shallow crater. c. Stage 3. A full thickness of skin is lost, exposing the subcutaneous tissues - presents as a deep crater with or without undermining adjacent tissue. d. Stage 4. A full thickness of skin and subcutaneous tissue is lost, exposing muscle or bone.	
2.	TYPE OF ULCER	*(For each type of ulcer, code for the highest stage in the last 7 days using scale in item M1—i.e., 0=none, stages 1, 2, 3, 4)* a. Pressure ulcer—any lesion caused by pressure resulting in damage of underlying tissue b. Stasis ulcer—open lesion caused by poor circulation in the lower extremities	
3.	HISTORY OF RESOLVED ULCERS	Resident had an ulcer that was resolved or cured in LAST 90 DAYS 0. No 1. Yes	
4.	OTHER SKIN PROBLEMS OR LESIONS PRESENT	*(Check all that apply during last 7 days)* Abrasions, bruises [a.] Burns (second or third degree) [b.] Open lesions other than ulcers, rashes, cuts (e.g., cancer lesions) [c.] Rashes—e.g., intertrigo, eczema, drug rash, heat rash, herpes zoster [d.] Skin desensitized to pain or pressure [e.] Skin tears or cuts (other than surgery) [f.] Surgical wounds [g.] NONE OF ABOVE [h.]	
5.	SKIN TREATMENTS	*(Check all that apply during last 7 days)* Pressure relieving device(s) for chair [a.] Pressure relieving device(s) for bed [b.] Turning/repositioning program [c.] Nutrition or hydration intervention to manage skin problems [d.] Ulcer care [e.] Surgical wound care [f.] Application of dressings (with or without topical medications) other than to feet [g.] Application of ointments/medications (other than to feet) [h.] Other preventative or protective skin care (other than to feet) [i.] NONE OF ABOVE [j.]	
6.	FOOT PROBLEMS AND CARE	*(Check all that apply during last 7 days)* Resident has one or more foot problems—e.g., corns, calluses, bunions, hammer toes, overlapping toes, pain, structural problems [a.] Infection of the foot—e.g., cellulitis, purulent drainage [b.] Open lesions on the foot [c.] Nails/calluses trimmed during last 30 days [d.] Received preventative or protective foot care (e.g., used special shoes, inserts, pads, toe separators) [e.] Application of dressings (with or without topical medications) [f.] NONE OF ABOVE [g.]	

SECTION N. ACTIVITY PURSUIT PATTERNS

1.	TIME AWAKE	*(Check appropriate time periods over last 7 days)* Resident awake all or most of time (i.e., naps no more than one hour per time period) in the: Morning [a.] Afternoon [b.] Evening [c.] NONE OF ABOVE [d.]	
		(If resident is comatose, skip to Section O)	
2.	AVERAGE TIME INVOLVED IN ACTIVITIES	*(When awake and not receiving treatments or ADL care)* 0. Most—more than 2/3 of time 2. Little—less than 1/3 of time 1. Some—from 1/3 to 2/3 of time 3. None	
3.	PREFERRED ACTIVITY SETTINGS	*(Check all settings in which activities are preferred)* Own room [a.] Day/activity room [b.] Inside NH/off unit [c.] Outside facility [d.] NONE OF ABOVE [e.]	
4.	GENERAL ACTIVITY PREFERENCES (adapted to resident's current abilities)	*(Check all PREFERENCES whether or not activity is currently available to resident)* Cards/other games [a.] Crafts/arts [b.] Exercise/sports [c.] Music [d.] Reading/writing [e.] Spiritual/religious activities [f.] Trips/shopping [g.] Walking/wheeling outdoors [h.] Watching TV [i.] Gardening or plants [j.] Talking or conversing [k.] Helping others [l.] NONE OF ABOVE [m.]	

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5.	PREFERS CHANGE IN DAILY ROUTINE	*Code for resident preferences in daily routines* 0. No change 1. Slight change 2. Major change	
		a. Type of activities in which resident is currently involved	
		b. Extent of resident involvement in activities	

SECTION O. MEDICATIONS

1.	NUMBER OF MEDICATIONS	*(Record the number of different medications used in the last 7 days; enter "0" if none used)*	
2.	NEW MEDICATIONS	*(Resident currently receiving medications that were initiated during the last 90 days)* 0. No 1. Yes	
3.	INJECTIONS	*(Record the number of DAYS injections of any type received during the last 7 days; enter "0" if none used)*	
4.	DAYS RECEIVED THE FOLLOWING MEDICATION	*(Record the number of DAYS during last 7 days; enter "0" if not used. Note—enter "1" for long-acting meds used less than weekly)* a. Antipsychotic b. Antianxiety c. Antidepressant d. Hypnotic e. Diuretic	

SECTION P. SPECIAL TREATMENTS AND PROCEDURES

1.	SPECIAL TREATMENTS, PROCEDURES, AND PROGRAMS	a. SPECIAL CARE—*Check treatments or programs received during the last 14 days*	
		TREATMENTS Chemotherapy — a. Dialysis — b. IV medication — c. Intake/output — d. Monitoring acute medical condition — e. Ostomy care — f. Oxygen therapy — g. Radiation — h. Suctioning — i. Tracheostomy care — j. Transfusions — k. Ventilator or respirator — l. **PROGRAMS** Alcohol/drug treatment program — m. Alzheimer's/dementia special care unit — n. Hospice care — o. Pediatric unit — p. Respite care — q. Training in skills required to return to the community (e.g., taking medications, house work, shopping, transportation, ADLs) — r. *NONE OF ABOVE* — s.	
		b. THERAPIES - *Record the number of days and total minutes each of the following therapies was administered (for at least 15 minutes a day) in the last 7 calendar days (Enter 0 if none or less than 15 min. daily)* **[Note—count only post admission therapies]** (A) = # of days administered for 15 minutes or more (B) = total # of minutes provided in last 7 days	DAYS (A) / MIN (B)
		a. Speech - language pathology and audiology services	
		b. Occupational therapy	
		c. Physical therapy	
		d. Respiratory therapy	
		e. Psychological therapy (by any licensed mental health professional)	
2.	INTERVENTION PROGRAMS FOR MOOD, BEHAVIOR, COGNITIVE LOSS	*(Check all interventions or strategies used in last 7 days—no matter where received)* Special behavior symptom evaluation program — a. Evaluation by a licensed mental health specialist in last 90 days — b. Group therapy — c. Resident-specific deliberate changes in the environment to address mood/behavior patterns—e.g., providing bureau in which to rummage — d. Reorientation—e.g., cueing — e. *NONE OF ABOVE* — f.	
3.	NURSING REHABILITATION/ RESTORATIVE CARE	*Record the NUMBER OF DAYS each of the following rehabilitation or restorative techniques or practices was provided to the resident for more than or equal to 15 minutes per day in the last 7 days (Enter 0 if none or less than 15 min. daily.)* a. Range of motion (passive) b. Range of motion (active) c. Splint or brace assistance TRAINING AND SKILL PRACTICE IN: d. Bed mobility e. Transfer f. Walking g. Dressing or grooming h. Eating or swallowing i. Amputation/prosthesis care j. Communication k. Other	

4.	DEVICES AND RESTRAINTS	*(Use the following codes for last 7 days:)* 0. Not used 1. Used less than daily 2. Used daily	
		Bed rails a. — Full bed rails on all open sides of bed b. — Other types of side rails used (e.g., half rail, one side) c. Trunk restraint d. Limb restraint e. Chair prevents rising	
5.	HOSPITAL STAY(S)	Record number of times resident was admitted to hospital with an overnight stay in last 90 days (or since last assessment if less than 90 days). *(Enter 0 if no hospital admissions)*	
6.	EMERGENCY ROOM (ER) VISIT(S)	Record number of times resident visited ER without an overnight stay in last 90 days (or since last assessment if less than 90 days). *(Enter 0 if no ER visits)*	
7.	PHYSICIAN VISITS	In the LAST 14 DAYS (or since admission if less than 14 days in facility) how many days has the physician (or authorized assistant or practitioner) examined the resident? *(Enter 0 if none)*	
8.	PHYSICIAN ORDERS	In the LAST 14 DAYS (or since admission if less than 14 days in facility) how many days has the physician (or authorized assistant or practitioner) changed the resident's orders? *Do not include order renewals without change. (Enter 0 if none)*	
9.	ABNORMAL LAB VALUES	Has the resident had any abnormal lab values during the last 90 days (or since admission)? 0. No 1. Yes	

SECTION Q. DISCHARGE POTENTIAL AND OVERALL STATUS

1.	DISCHARGE POTENTIAL	a. Resident expresses/indicates preference to return to the community 0. No 1. Yes	
		b. Resident has a support person who is positive towards discharge 0. No 1. Yes	
		c. Stay projected to be of a short duration— discharge projected within 90 days (do not include expected discharge due to death) 0. No 2. Within 31-90 days 1. Within 30 days 3. Discharge status uncertain	
2.	OVERALL CHANGE IN CARE NEEDS	Resident's overall self sufficiency has changed significantly as compared to status of 90 days ago (or since last assessment if less than 90 days) 0. No change 1. Improved—receives fewer supports, needs less restrictive level of care 2. Deteriorated—receives more support	

SECTION R. ASSESSMENT INFORMATION

1.	PARTICIPATION IN ASSESSMENT	a. Resident: 0. No 1. Yes	
		b. Family: 0. No 1. Yes 2. No family	
		c. Significant other: 0. No 1. Yes 2. None	
2.	SIGNATURE OF PERSON COORDINATING THE ASSESSMENT:		
		a. Signature of RN Assessment Coordinator (sign on above line)	
		b. Date RN Assessment Coordinator signed as complete — Month — Day — Year	

Resident _____ Numeric Identifier _____

SECTION T. THERAPY SUPPLEMENT FOR MEDICARE PPS

1. SPECIAL TREATMENTS AND PROCEDURES

a. **RECREATION THERAPY**—*Enter number of days and total minutes of recreation therapy administered (for at least 15 minutes a day) in the last 7 days (Enter 0 if none).*

	DAYS (A)	MIN (B)
(A) = # of days administered for 15 minutes or more (B) = total # of minutes provided in last 7 days		

Skip unless this is a Medicare 5 day or Medicare readmission/return assessment.

b. **ORDERED THERAPIES**—*Has physician ordered any of following therapies to begin in FIRST 14 days of stay—physical therapy, occupational therapy, or speech pathology service?*
0. No 1. Yes

If not ordered, skip to item 2

c. Through day 15, provide an estimate of the number of days when at least 1 therapy service can be expected to have been delivered.

d. Through day 15, provide an estimate of the number of therapy minutes (across the therapies) that can be expected to be delivered?

2. WALKING WHEN MOST SELF SUFFICIENT

Complete item 2 if ADL self-performance score for TRANSFER (G.1.b.A) is 0,1,2, or 3 AND at least one of the following are present:

- Resident received physical therapy involving gait training (P.1.b.c)
- Physical therapy was ordered for the resident involving gait training (T.1.b)
- Resident received nursing rehabilitation for walking (P.3.f)
- Physical therapy involving walking has been discontinued within the past 180 days

Skip to item 3 if resident did not walk in last 7 days

(FOR FOLLOWING FIVE ITEMS, BASE CODING ON THE EPISODE WHEN THE RESIDENT WALKED THE FARTHEST WITHOUT SITTING DOWN. INCLUDE WALKING DURING REHABILITATION SESSIONS.)

a. **Furthest distance walked** without sitting down during this episode.

0. 150+ feet
1. 51-149 feet
2. 26-50 feet
3. 10-25 feet
4. Less than 10 feet

b. **Time walked** without sitting down during this episode.

0. 1-2 minutes
1. 3-4 minutes
2. 5-10 minutes
3. 11-15 minutes
4. 16-30 minutes
5. 31+ minutes

c. **Self-Performance in walking** during this episode.

0. *INDEPENDENT*—No help or oversight
1. *SUPERVISION*—Oversight, encouragement or cueing provided
2. *LIMITED ASSISTANCE*—Resident highly involved in walking; received physical help in guided maneuvering of limbs or other nonweight bearing assistance
3. *EXTENSIVE ASSISTANCE*—Resident received weight bearing assistance while walking

d. **Walking support provided** associated with this episode (code regardless of resident's self-performance classification).

0. No setup or physical help from staff
1. Setup help only
2. One person physical assist
3. Two+ persons physical assist

e. **Parallel bars** used by resident in association with this episode.

0. No 1. Yes

3. CASE MIX GROUP

Medicare _____ State _____

Appendix B. Level of FHI by Linguistic Communication.

Nominal Regression

Case Processing Summary

		N	Marginal Percentage
Linguistic Comprehension	Understood	458	3.8%
	Understand	1725	14.2%
	Both	4461	36.7%
	None	5511	45.3%
Functional Hearing Impairment	Mild	2803	23.1%
	Moderate to Severe	1464	12.0%
	None	7888	64.9%
Valid		12155	100.0%
Missing		99	
Total		12254	
Subpopulation		604[a]	

a. The dependent variable has only one value observed in 176 (29.1%) subpopulations.

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	11120.546			
Final	4331.131	6789.414	15	.000

Pseudo R-Square

Cox and Snell	.428
Nagelkerke	.478
McFadden	.248

Likelihood Ratio Tests

Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	4331.131[a]	.000	0	.
DELIRIUM	5073.834	742.703	3	.000
COG	5835.942	1504.810	3	.000
DEMENTIA	4341.329	10.197	3	.017
C11	4799.567	468.436	6	.000

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Parameter Estimates

Linguistic Comprehension		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Understood	Intercept	-3.350	.084	1605.330	1	.000			
	DELIRIUM	.183	.025	54.936	1	.000	1.201	1.144	1.260
	COG	.232	.021	116.922	1	.000	1.261	1.209	1.315
	DEMENTIA	-.409	.148	7.642	1	.006	.664	.497	.888
	[C11=1]	.262	.124	4.478	1	.034	1.300	1.020	1.658
	[C11=2]	.271	.192	1.983	1	.159	1.311	.899	1.910
	[C11=3]	0[a]	.	.	0	.	.	.	.
Understand	Intercept	-2.361	.051	2137.281	1	.000			
	DELIRIUM	.233	.016	224.256	1	.000	1.262	1.224	1.301
	COG	.207	.013	236.281	1	.000	1.230	1.198	1.263
	DEMENTIA	.009	.086	.010	1	.918	1.009	.853	1.194
	[C11=1]	.732	.071	106.340	1	.000	2.080	1.810	2.391
	[C11=2]	1.338	.095	199.693	1	.000	3.811	3.165	4.587
	[C11=3]	0[a]	.	.	0	.	.	.	.
Both	Intercept	-3.073	.057	2906.752	1	.000			
	DELIRIUM	.347	.014	620.905	1	.000	1.414	1.376	1.454
	COG	.439	.012	1289.850	1	.000	1.551	1.515	1.589
	DEMENTIA	.033	.074	.200	1	.655	1.034	.894	1.194
	[C11=1]	1.009	.066	236.787	1	.000	2.743	2.412	3.119
	[C11=2]	1.377	.092	224.800	1	.000	3.964	3.311	4.746
	[C11=3]	0[a]	.	.	0	.	.	.	.

[a]. This parameter is set to zero because it is redundant.

Appendix C. FHI as a predictor of hearing aid use.

Nominal Regression

Case Processing Summary

		N	Marginal Percentage
Hearing Aid Use	Yes	1634	13.3%
	No	10620	86.7%
Functional Hearing Impairment	Mild	2834	23.1%
	Moderate to Severe	1488	12.1%
	None	7932	64.7%
Valid		12254	100.0%
Missing		0	
Total		12254	
Subpopulation		3	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1805.935			
Final	23.396	1782.539	2	.000

Pseudo R-Square

Cox and Snell	.135
Nagelkerke	.249
McFadden	.185

Likelihood Ratio Tests

Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	23.396[a]	.000	0	.
C11	1805.935	1782.539	2	.000

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Parameter Estimates

Hearing Aid Use		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Yes	Intercept	-3.100	.055	3144.458	1	.000			
	[C11=1]	1.823	.072	648.302	1	.000	6.189	5.379	7.122
	[C11=2]	2.911	.076	1469.196	1	.000	18.376	15.835	21.325
	[C11=3]	0[a]	.	.	0	.	.	.	.

a. This parameter is set to zero because it is redundant.

Appendix D. Level of FHI and use of a hearing aid as a predictor of symptoms of depression.

Nominal Regression

Case Processing Summary

		N	Marginal Percentage
MDS - DRS	Mild SOD	1963	16.0%
	Mod/Sev SOD	966	7.9%
	No SOD	9325	76.1%
Functional Hearing Impairment	Mild	2834	23.1%
	Moderate to Severe	1488	12.1%
	None	7932	64.7%
Hearing Aid Use	Yes	1634	13.3%
	No	10620	86.7%
Valid		12254	100.0%
Missing		0	
Total		12254	
Subpopulation		4351[a]	

a. The dependent variable has only one value observed in 3324 (76.4%) subpopulations.

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	11798.953			
Final	10227.743	1571.210	14	.000

Pseudo R-Square

Cox and Snell	.120
Nagelkerke	.160
McFadden	.091

Likelihood Ratio Tests

Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	10227.743[a]	.000	0	.
DELIRIUM	11138.084	910.341	2	.000
COG	10262.872	35.129	2	.000
DEMENTIA	10301.303	73.560	2	.000
ADL	10230.263	2.519	2	.284
C11	10297.043	69.300	4	.000
MAID	10238.855	11.112	2	.004

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Parameter Estimates

MDS - DRS		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B) Lower Bound	Upper Bound
Mild SOD	Intercept	-2.230	.061	1346.758	1	.000			
	DELIRIUM	.212	.011	396.450	1	.000	1.237	1.211	1.263
	COG	-.038	.012	9.758	1	.002	.963	.940	.986
	DEMENTIA	.275	.065	17.698	1	.000	1.317	1.158	1.497
	ADL	.008	.006	1.781	1	.182	1.008	.996	1.020
	[C11=1]	.286	.063	20.923	1	.000	1.331	1.178	1.505
	[C11=2]	.539	.083	42.131	1	.000	1.714	1.457	2.017
	[C11=3]	0[a]	.	.	0	.	.	.	.
	[MAID=0]	-.198	.084	5.561	1	.018	.820	.696	.967
	[MAID=1]	0[a]	.	.	0	.	.	.	.
Mod/Sev SOD	Intercept	-3.272	.091	1299.518	1	.000			
	DELIRIUM	.345	.013	688.791	1	.000	1.412	1.376	1.449
	COG	-.095	.017	30.253	1	.000	.909	.879	.941
	DEMENTIA	.714	.086	68.436	1	.000	2.042	1.724	2.418
	ADL	-.005	.009	.376	1	.540	.995	.978	1.012
	[C11=1]	.314	.087	13.109	1	.000	1.369	1.155	1.624
	[C11=2]	.650	.110	34.765	1	.000	1.916	1.543	2.378
	[C11=3]	0[a]	.	.	0	.	.	.	.
	[MAID=0]	-.327	.120	7.410	1	.006	.721	.569	.912
	[MAID=1]	0[a]	.	.	0	.	.	.	.

a. This parameter is set to zero because it is redundant.

Appendix E. Level of FHI as a predictor of anhedonia.

Nominal Regression

Case Processing Summary

		N	Marginal Percentage
Anhedonia	Yes	3869	31.6%
	No	8385	68.4%
Functional Hearing Impairment	Mild	2834	23.1%
	Moderate to Severe	1488	12.1%
	None	7932	64.7%
Valid		12254	100.0%
Missing		0	
Total		12254	
Subpopulation		3786[a]	

a. The dependent variable has only one value observed in 2644 (69.8%) subpopulations.

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	8923.090			
Final	7150.768	1772.322	6	.000

Pseudo R-Square

Cox and Snell	.135
Nagelkerke	.189
McFadden	.116

Likelihood Ratio Tests

Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	7150.768[a]	.000	0	.
DELIRIUM	7762.033	611.265	1	.000
COG	7151.185	.417	1	.519
DEMENTIA	7162.329	11.561	1	.001
ADL	7288.108	137.340	1	.000
C11	7174.144	23.376	2	.000

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Parameter Estimates

Anhedonia		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Yes	Intercept	-2.044	.051	1594.448	1	.000			
	DELIRIUM	.213	.009	556.116	1	.000	1.237	1.216	1.259
	COG	.006	.010	.417	1	.518	1.006	.987	1.025
	DEMENTIA	.184	.054	11.607	1	.001	1.202	1.081	1.336
	ADL	.057	.005	134.789	1	.000	1.059	1.049	1.069
	[C11=1]	.130	.050	6.664	1	.010	1.139	1.032	1.258
	[C11=2]	.295	.064	21.255	1	.000	1.343	1.185	1.522
	[C11=3]	0[a]	.	.	0	.	.	.	.

a. *This parameter is set to zero because it is redundant.*

Appendix F. Level of FHI as a predictor of Social Engagement.

Nominal Regression

Case Processing Summary

		N	Marginal Percentage
Social Engagement	No	2845	23.2%
	Yes	9409	76.8%
Functional Hearing Impairment	Mild	2834	23.1%
	Moderate to Severe	1488	12.1%
	None	7932	64.7%
Valid		12254	100.0%
Missing		0	
Total		12254	
Subpopulation		3786[a]	

a. The dependent variable has only one value observed in 2902 (76.7%) subpopulations.

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	9207.168			
Final	5834.378	3372.790	6	.000

Pseudo R-Square

Cox and Snell	.241
Nagelkerke	.364
McFadden	.254

Likelihood Ratio Tests

Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	5834.378[a]	.000	0	.
DELIRIUM	5904.794	70.416	1	.000
COG	6387.059	552.681	1	.000
DEMENTIA	5834.385	.007	1	.934
ADL	6332.701	498.323	1	.000
C11	5843.100	8.722	2	.013

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Parameter Estimates

Social Engagement		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
No	Intercept	-4.208	.083	2576.284	1	.000			
	DELIRIUM	.077	.009	70.457	1	.000	1.080	1.061	1.100
	COG	.257	.011	520.410	1	.000	1.294	1.265	1.322
	DEMENTIA	-.005	.059	.007	1	.934	.995	.887	1.117
	ADL	.139	.007	445.556	1	.000	1.149	1.134	1.163
	[C11=1]	.081	.059	1.844	1	.174	1.084	.965	1.218
	[C11=2]	.209	.072	8.389	1	.004	1.233	1.070	1.420
	[C11=3]	0[a]	.	.	0	.	.	.	.

a. This parameter is set to zero because it is redundant.

Appendix G. Level of FHI as a predictor of Activity Level.

Nominal Regression

Case Processing Summary

		N	Marginal Percentage
Activity Level	Low	10075	82.2%
	High	2178	17.8%
Functional Hearing Impairment	Mild	2834	23.1%
	Moderate to Severe	1488	12.1%
	None	7931	64.7%
Valid		12253	100.0%
Missing		1	
Total		12254	
Subpopulation		3786[a]	

a. The dependent variable has only one value observed in 3122 (82.5%) subpopulations.

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	5558.184			
Final	4649.762	908.422	6	.000

Pseudo R-Square

Cox and Snell	.071
Nagelkerke	.118
McFadden	.079

Likelihood Ratio Tests

Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	4649.762[a]	.000	0	.
DELIRIUM	4698.532	48.770	1	.000
COG	4703.415	53.652	1	.000
DEMENTIA	4655.754	5.992	1	.014
ADL	4869.631	219.869	1	.000
C11	4656.496	6.734	2	.034

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Parameter Estimates

Activity Level		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Low	Intercept	.426	.046	86.365	1	.000			
	DELIRIUM	.095	.014	45.332	1	.000	1.099	1.070	1.130
	COG	.092	.013	52.220	1	.000	1.096	1.069	1.124
	DEMENTIA	-.186	.076	6.044	1	.014	.830	.716	.963
	ADL	.080	.005	215.803	1	.000	1.084	1.072	1.095
	[C11=1]	-.024	.061	.151	1	.697	.977	.868	1.100
	[C11=2]	.214	.089	5.791	1	.016	1.239	1.041	1.476
	[C11=3]	0[a]	.	.	0	.	.	.	.

a. This parameter is set to zero because it is redundant.

Appendix H. Goodness of Fit Statistics for Initial and Final Models using Two Subsamples.

Initial Model: Subsample 1

L I S R E L 7.20

BY

KARL G JORESKOG AND DAG SORBOM

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THE FOLLOWING LISREL CONTROL LINES HAVE BEEN READ :

```
   DA NI=10 NO=   .000000E+00    XM=-0.989898D+09
RA FI=c:\windows\temp\spssb12.tmp FO
(5E14.6)
LA
C1 C2 HEARING LAWTON MDSDRS SOCIALEN ANHEDONIA DELIRIUM ADL ACTIVITY
SE
C1 C2 SOCIALEN ACTIVITY MDSDRS ANHEDONIA LAWTON DELIRIUM ADL HEARING/
MO NY=6 NX=4 FIXED-X NE=3 BE=SD PS=DI
LE
COMPREHENSION ACTIVITY MOOD
FREE LY(4,2) LY(6,3) LY(2,1)
VA 1 LY(1,1) LY(3,2)LY (5,3)
OU SE TV AD-OFF MI
```

NUMBER OF INPUT VARIABLES 10

NUMBER OF Y - VARIABLES 6

NUMBER OF X - VARIABLES 4

NUMBER OF ETA - VARIABLES 3

NUMBER OF KSI - VARIABLES 4

NUMBER OF OBSERVATIONS 6177

COVARIANCE MATRIX TO BE ANALYZED

	C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
C1	1.026					
C2	.678	.987				
SOCIALEN	.416	.375	.989			
ACTIVITY	.225	.206	.416	.987		
MDSDRS	.172	.174	.229	.160	1.012	
ANHEDONI	.285	.261	.367	.242	.401	1.019
LAWTON	.620	.568	.545	.298	.218	.309
DELIRIUM	.484	.468	.416	.271	.392	.383
ADL	.446	.368	.486	.331	.157	.262
HEARING	.222	.249	.146	.094	.130	.111

COVARIANCE MATRIX TO BE ANALYZED

	LAWTON	DELIRIUM	ADL	HEARING
LAWTON	.990			
DELIRIUM	.613	.996		
ADL	.492	.394	.995	
HEARING	.209	.159	.119	1.024

PARAMETER SPECIFICATIONS

LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	0	0	0
C2	1	0	0
SOCIALEN	0	0	0
ACTIVITY	0	2	0
MDSDRS	0	0	0
ANHEDONI	0	0	3

BETA

	COMPREHE	ACTIVITY	MOOD
COMPREHE	0	0	0
ACTIVITY	4	0	0
MOOD	5	6	0

GAMMA

	LAWTON	DELIRIUM	ADL	HEARING
COMPREHE	7	8	9	10
ACTIVITY	11	12	13	14
MOOD	15	16	17	18

PHI

	LAWTON	DELIRIUM	ADL	HEARING
LAWTON	0			
DELIRIUM	0	0		
ADL	0	0	0	
HEARING	0	0	0	0

PSI

COMPREHE	ACTIVITY	MOOD
19	20	21

THETA EPS

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
22	23	24	25	26	27

INITIAL ESTIMATES (TSLS)

LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	1.000	.000	.000
C2	.915	.000	.000
SOCIALEN	.000	1.000	.000
ACTIVITY	.000	.601	.000
MDSDRS	.000	.000	1.000
ANHEDONI	.000	.000	1.508

BETA

	COMPREHE	ACTIVITY	MOOD
COMPREHE	.000	.000	.000
ACTIVITY	.058	.000	.000
MOOD	.033	.292	.000

GAMMA

	LAWTON	DELIRIUM	ADL	HEARING
COMPREHE	.439	.157	.136	.109
ACTIVITY	.287	.100	.297	.023
MOOD	-.092	.224	-.039	.027

COVARIANCE MATRIX OF ETA AND KSI

	COMPREHE	ACTIVITY	MOOD	LAWTON	DELIRIUM	ADL
COMPREHE	.741					
ACTIVITY	.403	.693				
MOOD	.186	.247	.266			
LAWTON	.621	.532	.209	.990		
DELIRIUM	.496	.425	.296	.613	.996	
ADL	.426	.503	.169	.492	.394	.995
HEARING	.245	.149	.091	.209	.159	.119

COVARIANCE MATRIX OF ETA AND KSI

	HEARING
HEARING	1.024

PSI

COMPREHE	ACTIVITY	MOOD
.306	.322	.144

THETA EPS

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
.285	.366	.296	.737	.746	.415

SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
.722	.629	.701	.254	.263	.593

TOTAL COEFFICIENT OF DETERMINATION FOR Y - VARIABLES IS .973

SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

COMPREHE	ACTIVITY	MOOD
.587	.536	.456

TOTAL COEFFICIENT OF DETERMINATION FOR STRUCTURAL EQUATIONS IS .768

LISREL ESTIMATES (MAXIMUM LIKELIHOOD)

LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	1.000	.000	.000
C2	.923	.000	.000
SOCIALEN	.000	1.000	.000
ACTIVITY	.000	.615	.000
MDSDRS	.000	.000	1.000
ANHEDONI	.000	.000	1.128

BETA

	COMPREHE	ACTIVITY	MOOD
COMPREHE	.000	.000	.000
ACTIVITY	.072	.000	.000
MOOD	.031	.352	.000

GAMMA

	LAWTON	DELIRIUM	ADL	HEARING
COMPREHE	.438	.154	.139	.106
ACTIVITY	.300	.087	.280	.020
MOOD	-.118	.283	-.043	.036

COVARIANCE MATRIX OF ETA AND KSI

	COMPREHE	ACTIVITY	MOOD	LAWTON	DELIRIUM	ADL
COMPREHE	.735					
ACTIVITY	.405	.677				
MOOD	.222	.290	.355			
LAWTON	.618	.537	.251	.990		
DELIRIUM	.493	.419	.361	.613	.996	
ADL	.427	.494	.202	.492	.394	.995
HEARING	.241	.147	.111	.209	.159	.119

COVARIANCE MATRIX OF ETA AND KSI

	HEARING
HEARING	1.024

PSI

COMPREHE	ACTIVITY	MOOD
.303	.309	.178

THETA EPS

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
.291	.361	.312	.731	.656	.567

SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
.716	.635	.684	.260	.351	.443

TOTAL COEFFICIENT OF DETERMINATION FOR Y - VARIABLES IS .966

SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

COMPREHE	ACTIVITY	MOOD
.587	.543	.498

TOTAL COEFFICIENT OF DETERMINATION FOR STRUCTURAL EQUATIONS IS .778

CHI-SQUARE WITH 18 DEGREES OF FREEDOM = 302.16 (P = .000)

GOODNESS OF FIT INDEX = .990
ADJUSTED GOODNESS OF FIT INDEX = .971
ROOT MEAN SQUARE RESIDUAL = .022

SUMMARY STATISTICS FOR FITTED RESIDUALS
SMALLEST FITTED RESIDUAL = -.061
MEDIAN FITTED RESIDUAL = .000
LARGEST FITTED RESIDUAL = .041

STEMLEAF PLOT
- 6|1
- 4|05
- 2|3226544
- 0|9949733100000000000000000
0|123812399
2|6679145
4|01

```
SUMMARY STATISTICS FOR STANDARDIZED RESIDUALS
SMALLEST STANDARDIZED RESIDUAL =   -9.081
  MEDIAN STANDARDIZED RESIDUAL =     .000
 LARGEST STANDARDIZED RESIDUAL =    6.503


STEMLEAF PLOT
- 8|1
- 6|
- 4|920
- 2|9607650
- 0|9797421000000000000000000
  0|12382348
  2|06126
  4|2334
  6|5


LARGEST NEGATIVE STANDARDIZED RESIDUALS

RESIDUAL FOR ACTIVITY AND       C1 =  -2.653

RESIDUAL FOR ACTIVITY AND       C2 =  -2.627

RESIDUAL FOR   MDSDRS AND       C1 =  -5.911

RESIDUAL FOR   MDSDRS AND       C2 =  -3.586

RESIDUAL FOR   MDSDRS AND SOCIALEN =  -9.081

RESIDUAL FOR   LAWTON AND ACTIVITY =  -3.884

RESIDUAL FOR   LAWTON AND   MDSDRS =  -4.006

RESIDUAL FOR DELIRIUM AND ANHEDONI =  -3.039

RESIDUAL FOR  ADL AND MDSDRS       =  -5.195


LARGEST POSITIVE STANDARDIZED RESIDUALS

RESIDUAL FOR ANHEDONI AND       C1 =   4.432

RESIDUAL FOR ANHEDONI AND       C2 =   3.605

RESIDUAL FOR ANHEDONI AND SOCIALEN =   6.503

RESIDUAL FOR ANHEDONI AND ACTIVITY =   4.332

RESIDUAL FOR   LAWTON AND ANHEDONI =   3.229
```

RESIDUAL FOR DELIRIUM AND MDSDRS = 4.220

RESIDUAL FOR ADL AND ACTIVITY = 3.140

RESIDUAL FOR ADL AND ANHEDONI = 4.322

RESIDUAL FOR HEARING AND C2 = 2.611

STANDARD ERRORS

LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	.000	.000	.000
C2	.015	.000	.000
SOCIALEN	.000	.000	.000
ACTIVITY	.000	.019	.000
MDSDRS	.000	.000	.000
ANHEDONI	.000	.000	.038

BETA

	COMPREHE	ACTIVITY	MOOD
COMPREHE	.000	.000	.000
ACTIVITY	.022	.000	.000
MOOD	.020	.028	.000

GAMMA

	LAWTON	DELIRIUM	ADL	HEARING
COMPREHE	.012	.011	.010	.009
ACTIVITY	.016	.013	.012	.010
MOOD	.017	.013	.013	.009

PSI

COMPREHE	ACTIVITY	MOOD
.010	.018	.012

THETA EPS

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
.010	.010	.018	.015	.016	.018

T-VALUES

LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	.000	.000	.000
C2	61.143	.000	.000
SOCIALEN	.000	.000	.000
ACTIVITY	.000	32.847	.000
MDSDRS	.000	.000	.000
ANHEDONI	.000	.000	29.834

BETA

	COMPREHE	ACTIVITY	MOOD
COMPREHE	.000	.000	.000
ACTIVITY	3.244	.000	.000
MOOD	1.536	12.673	.000

GAMMA

	LAWTON	DELIRIUM	ADL	HEARING
COMPREHE	35.295	13.554	13.495	11.921
ACTIVITY	18.204	6.702	23.870	1.957
MOOD	-6.940	21.430	-3.330	3.911

PSI

COMPREHE	ACTIVITY	MOOD
28.993	17.412	15.261

THETA EPS

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
28.197	36.112	17.787	50.126	40.295	32.337

MODIFICATION INDICES AND ESTIMATED CHANGE

MODIFICATION INDICES FOR LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	.000	5.255	2.564
C2	.000	5.255	2.564
SOCIALEN	15.850	.000	7.902
ACTIVITY	15.850	.000	7.902

MDSDRS	53.752	152.037	.000
ANHEDONI	53.752	152.038	.000

ESTIMATED CHANGE FOR LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	.000	.059	-.047
C2	.000	-.054	.043
SOCIALEN	.162	.000	-.169
ACTIVITY	-.100	.000	.104
MDSDRS	-.171	-.397	.000
ANHEDONI	.193	.448	.000

NO NON-ZERO MODIFICATION INDICES FOR BETA

NO NON-ZERO MODIFICATION INDICES FOR GAMMA

NO NON-ZERO MODIFICATION INDICES FOR PSI

NO NON-ZERO MODIFICATION INDICES FOR THETA EPS

MAXIMUM MODIFICATION INDEX IS 152.04 FOR ELEMENT (6, 2) OF LAMBDA Y

THE PROBLEM USED 13184 BYTES (= .8% OF AVAILABLE WORKSPACE)

TIME USED : 7.1 SECONDS

Appendix I. Gamma and Beta Matrices for the Final Model with the Second Subsample.

Final Model: Subsample 2

L I S R E L 7.20

BY

KARL G JORESKOG AND DAG SORBOM

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1525 East 53rd Street, Suite 906
Chicago, Illinois 60615, U.S.A.
(800)247-6113 or (312)684-4979

THE FOLLOWING LISREL CONTROL LINES HAVE BEEN READ :

```
   DA NI=10 NO=    .000000E+00    XM=-0.989898D+09
RA FI=c:\windows\temp\spssb9.tmp FO
(5E14.6)
LA
C1 C2 HEARING LAWTON MDSDRS SOCIALEN ANHEDONIA DELIRIUM ADL ACTIVITY
SE
C1 C2 SOCIALEN ACTIVITY MDSDRS ANHEDONIA LAWTON DELIRIUM ADL HEARING/
MO NY=6 NX=4 FIXED-X NE=3 BE=SD PS=DI
LE
COMPREHENSION ACTIVITY MOOD
FREE LY(4,2) LY(6,3) LY(2,1)LY(6,2)
VA 1 LY(1,1) LY(3,2)LY (5,3)
OU SE TV AD-OFF MI
```

NUMBER OF INPUT VARIABLES 10

NUMBER OF Y - VARIABLES 6

NUMBER OF X - VARIABLES 4

NUMBER OF ETA - VARIABLES 3

NUMBER OF KSI - VARIABLES 4

NUMBER OF OBSERVATIONS 6077

COVARIANCE MATRIX TO BE ANALYZED

	C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
C1	.973					
C2	.670	1.013				
SOCIALEN	.408	.383	1.011			
ACTIVITY	.235	.218	.434	1.013		
MDSDRS	.196	.205	.244	.167	.988	
ANHEDONI	.284	.262	.373	.263	.421	.980
LAWTON	.606	.588	.563	.310	.233	.300
DELIRIUM	.489	.487	.426	.265	.420	.390
ADL	.443	.369	.513	.346	.169	.269
HEARING	.195	.227	.131	.081	.118	.109

COVARIANCE MATRIX TO BE ANALYZED

	LAWTON	DELIRIUM	ADL	HEARING
LAWTON	1.011			
DELIRIUM	.629	1.004		
ADL	.509	.409	1.005	
HEARING	.202	.159	.127	.976

PARAMETER SPECIFICATIONS

LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	0	0	0
C2	1	0	0
SOCIALEN	0	0	0
ACTIVITY	0	2	0
MDSDRS	0	0	0
ANHEDONI	0	3	4

BETA

	COMPREHE	ACTIVITY	MOOD
COMPREHE	0	0	0
ACTIVITY	5	0	0
MOOD	6	7	0

GAMMA

	LAWTON	DELIRIUM	ADL	HEARING

COMPREHE	8	9	10	11
ACTIVITY	12	13	14	15
MOOD	16	17	18	19

PHI

	LAWTON	DELIRIUM	ADL	HEARING
LAWTON	0			
DELIRIUM	0	0		
ADL	0	0	0	
HEARING	0	0	0	0

PSI

COMPREHE	ACTIVITY	MOOD
20	21	22

THETA EPS

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
23	24	25	26	27	28

INITIAL ESTIMATES (TSLS)

LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	1.000	.000	.000
C2	.924	.000	.000
SOCIALEN	.000	1.000	.000
ACTIVITY	.000	.636	.000
MDSDRS	.000	.000	1.000
ANHEDONI	.000	.283	.356

BETA

	COMPREHE	ACTIVITY	MOOD
COMPREHE	.000	.000	.000
ACTIVITY	.086	.000	.000
MOOD	.034	.230	.000

GAMMA

	LAWTON	DELIRIUM	ADL	HEARING
COMPREHE	.424	.174	.123	.092
ACTIVITY	.272	.099	.314	.006
MOOD	-.158	.450	-.060	.059

COVARIANCE MATRIX OF ETA AND KSI

	COMPREHE	ACTIVITY	MOOD	LAWTON	DELIRIUM	ADL
COMPREHE	.725					
ACTIVITY	.416	.755				
MOOD	.237	.276	.963			
LAWTON	.620	.552	.252	1.011		
DELIRIUM	.506	.444	.456	.629	1.004	
ADL	.423	.532	.187	.509	.409	1.005
HEARING	.219	.135	.127	.202	.159	.127

COVARIANCE MATRIX OF ETA AND KSI

	HEARING
HEARING	.976

PSI

COMPREHE	ACTIVITY	MOOD
.301	.356	.730

THETA EPS

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
.249	.394	.256	.709	.025	.742

SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
.745	.611	.746	.301	.975	.243

TOTAL COEFFICIENT OF DETERMINATION FOR Y - VARIABLES IS .999

SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

COMPREHE	ACTIVITY	MOOD
.584	.528	.242

TOTAL COEFFICIENT OF DETERMINATION FOR STRUCTURAL EQUATIONS IS .753

LISREL ESTIMATES (MAXIMUM LIKELIHOOD)

LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	1.000	.000	.000
C2	.966	.000	.000
SOCIALEN	.000	1.000	.000
ACTIVITY	.000	.618	.000
MDSDRS	.000	.000	1.000
ANHEDONI	.000	.310	.633

BETA

	COMPREHE	ACTIVITY	MOOD
COMPREHE	.000	.000	.000
ACTIVITY	.084	.000	.000
MOOD	.037	.259	.000

GAMMA

	LAWTON	DELIRIUM	ADL	HEARING
COMPREHE	.415	.168	.126	.087
ACTIVITY	.300	.072	.300	.002
MOOD	-.176	.417	-.068	.054

COVARIANCE MATRIX OF ETA AND KSI

	COMPREHE	ACTIVITY	MOOD	LAWTON	DELIRIUM	ADL
COMPREHE	.694					
ACTIVITY	.402	.706				
MOOD	.212	.249	.543			
LAWTON	.607	.553	.226	1.011		
DELIRIUM	.495	.426	.417	.629	1.004	
ADL	.418	.519	.169	.509	.409	1.005
HEARING	.212	.130	.116	.202	.159	.127

COVARIANCE MATRIX OF ETA AND KSI

	HEARING
HEARING	.976

PSI

COMPREHE	ACTIVITY	MOOD
.287	.320	.342

THETA EPS

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
.280	.366	.305	.744	.445	.596

SQUARED MULTIPLE CORRELATIONS FOR Y - VARIABLES

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
.713	.638	.698	.266	.550	.391

TOTAL COEFFICIENT OF DETERMINATION FOR Y - VARIABLES IS .974

SQUARED MULTIPLE CORRELATIONS FOR STRUCTURAL EQUATIONS

COMPREHE	ACTIVITY	MOOD
.586	.547	.370

TOTAL COEFFICIENT OF DETERMINATION FOR STRUCTURAL EQUATIONS IS .784

CHI-SQUARE WITH 17 DEGREES OF FREEDOM = 146.34 (P = .000)

GOODNESS OF FIT INDEX = .995
ADJUSTED GOODNESS OF FIT INDEX = .984
ROOT MEAN SQUARE RESIDUAL = .012

SUMMARY STATISTICS FOR FITTED RESIDUALS
SMALLEST FITTED RESIDUAL = -.034
MEDIAN FITTED RESIDUAL = .000
LARGEST FITTED RESIDUAL = .030

STEMLEAF PLOT
- 3|42
- 2|2
- 1|7654
- 0|7665554210000000000000000000000
0|112223679
1|013
2|3555
3|0

```
SUMMARY STATISTICS FOR STANDARDIZED RESIDUALS
SMALLEST STANDARDIZED RESIDUAL =   -3.619
  MEDIAN STANDARDIZED RESIDUAL =     .000
 LARGEST STANDARDIZED RESIDUAL =    3.295


STEMLEAF PLOT
- 3|62
- 2|42
- 1|8751
- 0|876665510000000000000000000000
  0|11223478
  1|0024
  2|3479
  3|3


LARGEST NEGATIVE STANDARDIZED RESIDUALS

RESIDUAL FOR   LAWTON AND ACTIVITY =  -3.619

RESIDUAL FOR      ADL AND       C2 =  -3.242


LARGEST POSITIVE STANDARDIZED RESIDUALS

RESIDUAL FOR ANHEDONI AND       C1 =   2.869

RESIDUAL FOR ANHEDONI AND ACTIVITY =   3.295

RESIDUAL FOR      ADL AND ACTIVITY =   2.703


STANDARD ERRORS

        LAMBDA Y

            COMPREHE   ACTIVITY       MOOD
            --------   --------   --------
      C1        .000       .000       .000
      C2        .016       .000       .000
SOCIALEN        .000       .000       .000
ACTIVITY        .000       .018       .000
  MDSDRS        .000       .000       .000
ANHEDONI        .000       .021       .034

        BETA

            COMPREHE   ACTIVITY       MOOD
            --------   --------   --------
COMPREHE        .000       .000       .000
ACTIVITY        .023       .000       .000
    MOOD        .026       .030       .000
```

GAMMA

	LAWTON	DELIRIUM	ADL	HEARING
COMPREHE	.012	.011	.010	.009
ACTIVITY	.016	.013	.012	.010
MOOD	.020	.016	.016	.012

PSI

COMPREHE	ACTIVITY	MOOD
.010	.017	.025

THETA EPS

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
.010	.010	.016	.015	.025	.015

T-VALUES

LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	.000	.000	.000
C2	60.687	.000	.000
SOCIALEN	.000	.000	.000
ACTIVITY	.000	34.004	.000
MDSDRS	.000	.000	.000
ANHEDONI	.000	14.941	18.356

BETA

	COMPREHE	ACTIVITY	MOOD
COMPREHE	.000	.000	.000
ACTIVITY	3.695	.000	.000
MOOD	1.437	8.708	.000

GAMMA

	LAWTON	DELIRIUM	ADL	HEARING
COMPREHE	34.187	15.054	12.470	9.791
ACTIVITY	18.264	5.434	25.421	.225
MOOD	-8.631	26.820	-4.312	4.691

PSI

COMPREHE	ACTIVITY	MOOD

28.819	19.029	13.601

THETA EPS

C1	C2	SOCIALEN	ACTIVITY	MDSDRS	ANHEDONI
28.284	35.457	18.486	49.819	17.673	40.654

MODIFICATION INDICES AND ESTIMATED CHANGE

MODIFICATION INDICES FOR LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	.000	9.980	2.619
C2	.000	9.980	2.619
SOCIALEN	2.586	.000	6.018
ACTIVITY	8.506	.000	6.018
MDSDRS	4.932	.000	.000
ANHEDONI	4.932	.000	.000

ESTIMATED CHANGE FOR LAMBDA Y

	COMPREHE	ACTIVITY	MOOD
C1	.000	.076	-.033
C2	.000	-.074	.032
SOCIALEN	.062	.000	-.095
ACTIVITY	-.072	.000	.059
MDSDRS	-.078	.000	.000
ANHEDONI	.050	.000	.000

NO NON-ZERO MODIFICATION INDICES FOR BETA

NO NON-ZERO MODIFICATION INDICES FOR GAMMA

NO NON-ZERO MODIFICATION INDICES FOR PSI

NO NON-ZERO MODIFICATION INDICES FOR THETA EPS

MAXIMUM MODIFICATION INDEX IS 9.98 FOR ELEMENT (2, 2) OF LAMBDA Y

THE PROBLEM USED 13456 BYTES (= .8% OF AVAILABLE WORKSPACE)

TIME USED : 7.1 SECONDS