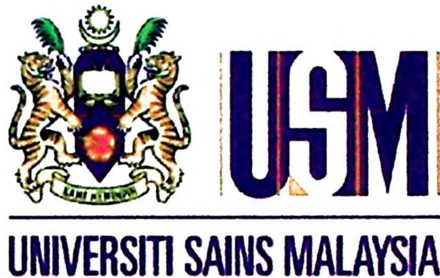

PREVALENCE OF HEARING LOSS AND IMPACT OF HEARING HANDICAP ON QUALITY OF LIFE IN ELDERLY IN KELANTAN

BY

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LIST OF ABBREVIATIONS

%	: Percent
ADLs	: Activities of daily living
BP	: Bodily Pain
CHL	: Conductive hearing loss
EHLS-2	: Epidemiology of Hearing Loss Study
GH	: General Health
HHIE	: Hearing Handicap Inventory for the Elderly
HHIE-S	: Hearing Handicap Inventory for the Elderly Screening Version
IADLs	: Instrumental activities of daily living
IQOLA	: Aegis of International Quality of Life Assessment
MCS	: Mental Component Summary
MH	: Mental Health
PCS	: Physical Component Summary
PF	: Physical Functioning
PTA	: Pure tone average
QoL	: Quality of life
RE	: Role-emotional
RP	: Role-physical
SF	: Social Functioning
SF-36	: Short Form 36 Health Survey
SNHL	: Sensorineural Hearing loss
VT	: Vitality

ABSTRACT

The purpose of this research aimed to study the impact of hearing handicap on quality of life (QoL) in elderly in Kelantan. A sample of 50 elderly from Pusat Aktiviti Warga Emas, Rumah Seri Kenangan and Audiology Clinic, Hospital USM was surveyed through hearing assessment and using questionnaires. The instruments were based upon demographic profile, Malay version Short Form 36 Health Survey (SF-36) and Malay version Hearing Handicap Inventory for the Elderly (HHIE). Malay version SF-36 assessed the QoL while the HHIE assessed the hearing handicap suffered by the elderly. The data was coded and analyzed using MedCalc and Pearson's correlation. Results show that all three categories (average ear, better ear and worse ear hearing loss) are correlated with the HHIE scores. However, the degree of hearing loss do not all correlate with HHIE scores. Only the better ear with moderate degree of hearing loss and worse ear with mild degree of hearing loss correlate with HHIE scores. The results also show that there is a correlation between HHIE and all domains of SF-36, physical composite summary (PCS) and mental composite summary (MCS), except physical functioning (PF). Since a reduction of QoL was correlated with hearing handicap, reduction in hearing handicap should be treated seriously as it showed reduction in the QoL of elderly. Thus, elderly patient should seek for proper hearing assessment when they came across with hearing difficulties.

ABSTRAK

Kajian ini dijalankan untuk melihat kesan masalah pendengaran terhadap kualiti kehidupan warga emas di Kelantan. Kajian ini telah dijalankan dengan menggunakan ujian pendengaran dan kaji selidik kepada sampel yang terdiri daripada 50 warga emas dari Pusat Aktiviti Warga Emas, Rumah Seri Kenangan dan Klinik Audiologi, Hospital USM. Borang kaji selidik terdiri daripada bahagian demografi responden, "Short Form 36 Health Survey" (SF-36) dan "Hearing Handicap Inventory for the Elderly" (HHIE) dalam versi Bahasa Melayu. SF-36 digunakan untuk menilai tahap kualiti kehidupan manakala HHIE digunakan untuk menilai tahap masalah pendengaran dalam kalangan warga emas. Data yang diperolehi dianalisis menggunakan pakej komputer MedCalc dengan menggunakan ujian "Pearson's correlation". Hasil kajian menunjukkan kaitan antara tiga kategori dalam kehilangan pendengaran ("average ear", "better ear" dan "worse ear") dengan HHIE. Walaubagaimanapun, tahap kehilangan pendengaran tidak semua berkaitan dengan HHIE. Hanya "better ear" tahap sederhana dan "worse ear" tahap ringan yang berkaitan dengan HHIE. Hasil kajian ini juga menunjukkan warga emas yang bermasalah pendengaran berhubungkait signifikan dengan semua kategori dalam soal selidik SF-36, iaitu "physical composite summary" (PCS) dan "mental composite summary" (MCS), kecuali "physical functioning" (PF). Kajian ini juga mendapati terdapat penurunan kualiti kehidupan dalam warga emas yang mempunyai masalah pendengaran. Oleh sebab itu, warga emas diseru untuk mendapat rawatan yang sewajarnya secepat mungkin jika terdapat masalah pendengaran.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Hearing loss was defined as the pure tone average of the air conduction hearing thresholds which was more than 25 dBHL for the average of four frequencies (0.5 to 4.0 kHz) in the better ear (Chew & Yeak, 2010). Schow (1991) reported that hearing loss, also known as hearing impairment, can cause hearing disability and hearing handicap. Hearing impairment refers to a deficit in structure or function, whereas hearing handicap and hearing disability refer to the effect of such a deficit.

The most typical chronic health problem in elderly, after hypertension and arthritis is hearing loss (Walling & Dickson, 2012). Ries (1994) reported that a huge proportion of people with hearing problem (43%) are 65 years of age or above. 60.9% of those who could not hear and understand normal speech are within this age range. The amount of normal hearing individuals who aged 65 years and above is only 9.7%. It is quite hard to find a person more than 70 years of age with no hearing problems or whose hearing sensitivity has not reduced since youthful levels (Gates & Mills, 2005).

According to Walling and Dickson (2012), hearing loss can be divided into conductive or sensorineural. Conductive hearing loss (CHL) is commonly due to problems in the external or middle ear that affects the transmission of sound and its conversion to mechanical vibrations. Sensorineural hearing loss (SNHL) happens when there are problems in converting mechanical vibrations to electrical potential in the

cochlea and/or in auditory nerve transmission to the brain. This is typically caused by permanent damage in the organ of Corti. Elderly may have both CHL and SNHL, as well as having cognitive difficulties in sound interpretation.

Presbycusis is the leading cause for SNHL among elderly. About 90% and above older persons with hearing loss have age-related SNHL, which is a gradual, symmetric loss of hearing that occurred at high frequencies and will get worse in noisy situations (Walling & Dickson, 2012). Moyer (2012) explained that presbycusis happens due to degeneration of the hair cells in the ear. Hearing loss may also happens due to other contributing factors such as exposure to loud noises, ototoxic agents, occupational exposures, previous recurring inner ear infections, genetic factors, and certain systemic diseases such as diabetes.

However, Loh and Elango (2005) reported that CHL may occur in elderly as well. CHL occurs as the sounds transmitted from the tympanic membrane to the inner ear are blocked. Some of the examples for CHL that may occur in elderly are: earwax in the ear canal, fluid in the middle ear, chronic otitis media, tympanic membrane perforation and otosclerosis.

Hearing level will become worse with age, but the severity of the hearing handicap has a great difference among different people (Gates & Mills, 2005). Many people may be unaware of mild to moderate hearing loss. According to Walling and Dickson (2012), this may be due to its insidious onset and progression, or because it is not obvious in quiet situations. There are only about 20% of people aged 65 years or older with moderate to profound hearing loss will perceive themselves as having

hearing impairment. Many people do not treat hearing loss as appropriate for medical management.

According to American Speech-Language-Hearing Association (ASHA) (1981), different people will face different hearing handicap. People with CHL do not face the same kind of communicative problems or manifestations of auditory dysfunction faced by people with SNHL. The communicative difficulties and auditory manifestations found in people with peripheral hearing problems are not the same as those with central auditory dysfunction. The degree to which a hearing loss is a handicapping condition will depend on the interaction of a number of factors, other than depending on the degree of hearing loss only.

Older adults with self-perceived hearing handicap constitute a potential risk group for overall deterioration in quality of life (QoL) (Gopinath et al., 2012). Hearing handicap will cause reduced QoL, cognitive decline, as well as depression (Walling & Dickson, 2012). Hearing loss is also associated with employment. According to Dalton et al. (2003), among men who are younger than 65 years of age with a hearing loss were less likely to be employed full time compared to men with normal hearing. Hearing loss could have serious economic implications for individuals as well as families as the main wage earner is unable to work due to the hearing handicap.

However, despite its prevalence and morbidity, Walling and Dickson (2012) reported that hearing loss is usually neglected and undertreated by others. This may be because of its slow developing nature or because of the perception that having a hearing loss is a normal part of aging. Without proper treatment and management, hearing loss

can cause serious psychological and social consequences such as depression and social isolation (Loh & Elango, 2005). Thus, study needs to be done to determine the impact of hearing loss on the QoL in elderly to ensure the consequences are properly addressed for further management.

1.2 Hearing Loss

Among the various health problems affecting the elderly, hearing loss is one of the most typical health problems for elderly age 60 or above which usually leads to verbal communication difficulty (Loh & Elango, 2005).

Walling and Dickson (2012) explained that about one-half of the likelihood to get age related hearing loss may be genetically determined and several genes may be involved in this. Other than that, noise exposure may contribute to the onset, but not to the progression of age-related hearing loss. Occasional exposure to 85 dB or more will increase the risk of having hearing loss by mechanical and metabolic damage to cochlear hair cells. Other implicated causes may be synergistic.

CHL often worsens age-related hearing loss. The most typical cause is cerumen or wax impaction that may exacerbate hearing loss up to 30% of the older person (Walling & Dickson, 2012).

1.3 Hearing Handicap

According to American Speech-Language-Hearing Association (ASHA) (1981), the terms hearing impairment, hearing handicap, and hearing disability are not synonymous as they convey different meanings. Hearing impairment, or hearing loss means a deviation or change for the worse in either auditory structure or auditory function, usually outside the normal range. Next, hearing handicap means the disadvantage due to the hearing impairment on a person's communicative performance in the activities of daily living. Hearing disability, on the other hand, means the determination of a financial award for the dysfunction caused by any hearing impairment that results in a significant hearing handicap.

1.4 Elderly

At the moment, there is no United Nations standard for the definition of 'elderly' or older person. However, the United Nations has agreed that the cut off point for elderly is 60 years and above to refer to the older population (World Health Organization, 2014)

According to Loh and Elango (2005), the number of individuals aged 60 years and above continues to increase globally. In Malaysia, it was announced that in the year 2000, 6.2% of the population were aged 60 and above. About 30% of elderly aged 60 years and above have some degree of hearing impairment.

Moyer (2012) reported that age-related SNHL is a typical health problem happens in adults aged 50 years or older. Aging is the most essential risk factor for hearing loss. Hearing loss can lead to disadvantages in social functioning and QoL.

1.5 Quality of Life (QoL)

The concept 'quality of life' has been widely used in different disciplines, but there is no general definition for it (Hallberg, Hallberg, & Kramer, 2008).

According to Bowling (1995), "QoL is an amorphous concept that has a usage across many disciplines – geography, literature, philosophy, health economics, advertising, health promotion and the medical and social sciences (e.g. sociology and psychology). It is also a vague concept; it is multidimensional and theoretically incorporates all aspects of an individual's life."

1.6 Problem Statement

Self-perceived hearing handicap is a strong predictor of declining QoL among older adults (Gopinath et al., 2012). Lichtenstein, Bess, and Logan (1988) explained that hearing impairment has caused hearing handicap in elderly, thus further causing them to have some psychological characteristic of depressive symptoms, confusion, inattentiveness, increased tension, and pessimistic. Most importantly, these have also been associated with some functional problems of poor general health, reduced mobility (decreased involvement in activities and excursions outside the home), and decreased

interpersonal communications. Thus, hearing handicap is a common condition which results in adverse psychosocial consequences for those who were hearing-impaired.

As acquired hearing handicap may cause adverse effects on the activities and participation in daily social life in a negative way, this may cause people with hearing impairment to become the risk group for hearing handicap and thus, having lowered QoL (Hallberg et al., 2008).

Lichtenstein et al. (1988) further elaborate that untreated hearing loss will cause elderly to easily felt frustrated as they do not understand what was being said. These hearing handicap sometimes may make them felt embarrassed during gathering as they were unable to communicate well, causing them to have social isolation. Despite all this, only 13% to 18% of the hearing-impaired elderly population that have actually obtains any form of amplification intervention.

The psychosocial consequences of hearing impairment, such as hearing handicap and QoL, cannot be predicted from audiometric data alone (Hallberg et al., 2008). However, not many studies have accessed the effect of age-related hearing loss and hearing handicap on QoL (Dalton et al., 2003), especially in the Asian populations. Thus, it is important to discover and study on whether having a hearing handicap will cause any serious consequences among the daily life of the elderly.

1.7 Study Objective

1.7.1 General Objective:

To determine the impact of hearing handicap on quality of life in elderly.

1.7.2 Specific Objectives:

1. To determine the prevalence of hearing loss in elderly in Kelantan.
2. To determine the correlation between hearing loss and HHIE scores which measures the hearing handicap in elderly.
3. To determine the correlation between degree of hearing loss and HHIE scores which measures the hearing handicap in elderly.
4. To determine the correlation between HHIE scores which measures the hearing handicap and the SF-36 scores which measures the quality of life in elderly.

1.8 Study Hypotheses

1. **Null Hypothesis, Ho:** There is no correlation between hearing loss and HHIE scores which measures the hearing handicap in elderly.

   Alternative Hypothesis, Ha: There is correlation between hearing loss and HHIE scores which measures the hearing handicap in elderly.

2. Null Hypothesis, Ho: There is no correlation between degree of hearing loss and HHIE scores which measures the hearing handicap in elderly.

Alternative Hypothesis, Ha: There is correlation between degree of hearing loss and HHIE scores which measures the hearing handicap in elderly.

3. Null Hypothesis, Ho: There is no correlation between HHIE scores which measures the hearing handicap and the SF-36 scores which measures the quality of life in elderly.

Alternative Hypothesis, Ha: There is correlation between HHIE scores which measures the hearing handicap and the SF-36 scores which measures the quality of life in elderly.

CHAPTER 2

LITERATURE REVIEW

2.1 Background of Study

According to Chew and Yeak (2010), the ways to measure the consequences of hearing loss range from audiometric measurements, through clinical tests including whisper test and tuning fork tests, to self-reported quality of life (QoL) questionnaires. QoL is broad and has a multidimensional concept which is better to be assessed by both objective and subjective measurements (Tsuruoka et al., 2001). Not many studies have accessed the effect of age-related hearing loss on QoL (Dalton et al., 2003), especially in Asian populations. The QoL measures can help in assisting documentation of the effect of chronic conditions and allow evaluation of health changes and post-interventional effects, and therefore assist the allocation of public health resources (Chew & Yeak, 2010).

2.1.1 Activities of daily living (ADLs) and Instrumental activities of daily living (IADLs)

Dalton et al. (2003) has collected audiometric, medical history and QoL data from the 5 year follow-up of the Epidemiology of Hearing Loss Study (EHLS-2), which is a population based longitudinal study of age-related hearing loss conducted in Beaver Dam, Wisconsin. The eligible participants (N = 2,688) were between 53 to 97 years old (mean age = 69 years old) and 42% of them were male. They used the HHIE-S,

activities of daily living (ADLs), instrumental activities of daily living (IADLs) and SF-36 questionnaire to conduct their study.

Dalton and colleagues (2003) used the ADL and IADL to obtain information on global functioning by asking questions. ADL and IADL measures different aspects in global functioning. ADL accessed whether participants needed any help to perform activities such as walking across a small room, bathing and personal grooming (brushing hair, brushing teeth,washing face) during the past month. IADL addressed activities such as pulling or pushing large objects, lifting or carrying weights under 10 lb and extending arms above shoulder level. Categories of ''none,'' ''a little,'' ''some,'' or ''a lot'' were rated. Those who reported some or a lot of difficulty, or not being able to perform one or more of these activities, were considered to have impaired ADL or IADL.

2.1.2 Short Form 36 (SF-36) Health Survey

A cross-sectional study has been done by Chew and Yeak (2010). Over two months, 80 patients aged 50 years and over with untreated hearing loss were recruited from Audiology clinic to study the QoL in patients with untreated age-related hearing loss. They used the Short Form 36 (SF-36) Health Survey and also used the Hearing Handicap Inventory for the Elderly Screening version questionnaire (HHIE-S) which is a hearing-specific questionnaire.

The SF-36 Health Survey is a well validated, generic, health-related QoL that widely measures across different disciplines. Study done by Newman, Jacobson, Hug,

and Sandridge (1997) showed a significant correlation even in participants with marginal hearing loss. On contrary, study done by Chew and Yeak (2010) found that the SF-36 Health Survey lacked sensitivity and specificity in assessing the impact of hearing loss on the QoL. Study done by Helvik, Jacobsen, and Hallberg (2006) also achieved similar conclusions; however, they used a different generic QoL instrument, which is the Psychological General Well-Being inventory.

Some studies have found out that women have lower psychosocial well-being than men (Helvik et al., 2006) but no conclusive evidence had been given for this findings. Study by Chew and Yeak (2010) showed that female gender and the existence of other medical conditions were associated with a significantly lower SF-36 Health Survey physical component score (PCS), even after controlling some possible confounders in the multivariate analysis. This may be due to health problems such as orthopaedic conditions and cardiovascular disease, which usually limit physical activity, commonly affect the elderly, and may result in a decrease in physical well-being. Women may have lower physical capacity and endurance which therefore contribute to a poorer physical component scores (PCS). The existence of other medical conditions are potential confounders including sleep problems, history of arthritis and other chronic disease (Dalton et al., 2003).

2.1.3 Hearing Handicap Inventory for the Elderly Screening Version (HHIE-S)

The HHIE-S is a series of standardized questions developed to screen for self assessed hearing handicap in elderly individuals. The questions consist of five social or situational items and five emotional response items. Chew and Yeak (2010) used 40

dBHL as the standard criterion for clinically significant hearing loss. They noticed that as the cut-off score increased, its specificity increased while its sensitivity decreased. Their results showed a highly significant correlation between the degree of hearing impairment and the degree of hearing handicap reported by subjects. Age-related hearing loss will cause high frequency hearing loss which leads to poor speech perception. This happens as the perception of consonants that give clarity to speech, is affected (Veras & Mattos, 2007). Chew and Yeak (2010) reported that such poor speech perception may lead to communication difficulties, which may then affect subjects'emotional and social well-being. Some subjects in the study reported having problems while listening to television, radio, whispered speech, and experienced frustration while communicating with their family members.

Dalton et al. (2003) also agreed with this statement as their study showed that the severity of hearing loss was significantly associated with presence of hearing handicap and self reported communication difficulties. In each age group, the prevalence of self-reported hearing handicap or communication difficulties increased with the severity of the hearing loss as measured by audiometry. However, among those with moderate to severe losses, as tested by audiometry, many people did not report having a hearing handicap or any communication difficulties.

2.1.4 Association between Activities of daily living (ADLs) and Instrumental activities of daily living (IADLs) with Short Form 36 (SF-36) Health Survey

Hearing loss was associated with reduced functioning as measured by ADLs and IADLs based on study done by Dalton et al. (2003). The ADLs measure more global

functioning in activities that happens in everyday living, such as toileting. Hearing loss may not be the direct cause of this reduction in physical function; however, even after other factors are controlled by them, it appears that people with hearing loss have more difficulty carrying out these tasks. This shows that hearing loss also contribute to the general decline and debility that can occur due to aging and is essential in the understanding of the effects of comorbidity on the loss of QoL in aging populations. The IADLs measures functioning in more subtle activities include shopping for personal items and taking care of personal finances. Hearing loss is associated with reduced function in these areas as with hearing loss, there is emergent of communication problems, which is an important aspect in daily living.

2.1.5 Association between Hearing Handicap Inventory for the Elderly Screening Version (HHIE-S) and Short Form 36 (SF-36) Health Survey

Based on the study done by Dalton et al. (2003), HHIE-S and self-report of communication difficulties were associated with decreased scores in each individual domains of the SF-36. Hearing loss, measured by audiometry, was associated with decreased scores in six of the eight individual domains. Although the absolute differences in the mean scores between the levels of hearing loss are small, they are possibly important. The developers of the SF-36 mentioned that differences as small as 2 points on the 100-point scale used for the individual domains are crucial to help in identifying in population bases studies (Ware, 1993).

Of the three measures of hearing, (HHIE-S, ADLs and IADLs), Dalton et al. (2003) concluded that HHIE-S resulted in the greatest difference in SF-36 scores.

According to his study, those reporting hearing handicap will have a greater severity of hearing loss. Other than that, people who reported feeling handicapped by their hearing may be more likely to report problems with other activities as well. With the use of audiometric measures for hearing loss, a less biased view of the overall impact of hearing loss on QoL may be obtained across the spectrum of hearing impairments present in a population.

Each of the three measures done by Dalton et al. (2003) was also associated with decreased scores on the MCS and PCS of the SF-36. Although these differences in the MCS and PCS are small, they are consistent with the published data demonstrating differences in people with hearing loss compared with the general population means (Ware, Kosinski, & Keller, 1994). The MCS and PCS are scaled so that a 10-point difference will represent 1 standard deviation and is comparable with a 20- to 30-point difference in the eight individual domain scores. The overall MCS and PCS scores for the study participants were slightly higher than the published population norms for men and women aged 65–74 years, which indicates the residents in Beaver Dam tend to report better health [Epidemiology of Hearing Loss Study (EHLS) overall MCS is 55.0, PCS is 45.2 compared to the population norm MCS is 52.7, PCS is 43.3]. However, the hearing impaired study participants had a lower PCS scores compared to the published norms for the hearing impaired (PCS is 38.8 for moderate to severe hearing loss compared to 43.7 published norm for the hearing impaired). This may reflect the younger age of the hearing impaired sample used in the published norms. The MCS for the study participants with moderate to severe hearing loss is very similar to the published norms for hearing impaired people (49.0 compared to 48.7).

Although Chew and Yeak (2010) concluded that untreated hearing loss does result in a significant decline in QoL, the believe of having hearing handicap (by answering as 'yes' or 'sometimes') was recorded by less than half (41.2 percent) of the subjects for HHIE-S. This may be due to subjects' different understandings of hearing handicap, disagree in having hearing loss in some, and the amount of social and family support received. Hearing loss may adversely affect not only the hearing-impaired person, but also the QoL of those living around them. The hearing-impaired person's frustrations and some of their action (increase the TV and radio volume) may cause discomfort for those around them. It is then useful to obtain the impact of hearing loss on the QoL of the affected person's family members to get a more precise finding of the overall impact of hearing loss.

Dalton et al. (2003) also supported this statement. They mentioned that one of the limitations of their study is that quality of life, hearing handicap, and difficulties with communication were by self-report from the participants. Although hearing loss certainly affects the hearing impaired person, it is possible that other individuals dealing with him or her may experience as much, or possibly more, frustration due to communication difficulties. It also is possible that individuals living with the hearing-impaired person may give more objective report on the impact of hearing loss on communication. When accessing the QoL of people with hearing loss, it may be more informative to investigate and evaluate the impact of hearing loss on the family as well as the hearing impaired individual.

On the other hand, Chew and Yeak (2010) also discover an imperfect relationship between the degree of hearing handicap (indicated by the HHIE-S

questionnaire) and the degree of hearing loss (determined audiometrically). Different person may have different degrees of hearing handicap from the same level of hearing loss. Thus, the psychosocial impact of hearing loss should not be assumed purely using audiometric findings (Hallberg et al., 2008). The HHIE-S questionnaire is a good screening tool for functional hearing impairment among older adults. It may be less sensitive in identifying early hearing loss, but it access individuals who were having handicap from their hearing loss and are then more likely to approve to, and gain from, interventional measures (e.g. audiological assessment, hearing aids fittings, and support groups). It is also easy to be used, and provides an easy, cheap and practical method for screening hearing loss, especially for those who are bedridden and physically debilitated elderly individuals, who may find it hard to go to an audiological centre for formal assessment. The questionnaire also helps in follow up as it is able to assess the QoL betterment for post-intervention (Chew & Yeak, 2010).

Chew and Yeak (2010) explained that untreated age-related hearing loss may have been underrecognized because of its invisibility, slow and gradual onset, perceived insignificance compared with other life-threatening conditions, and lack of data on QoL consequences. Untreated hearing loss in elderly will lead to a significant decline in QoL, which was proven by the HHIE-S questionnaire scores. The SF-36 Health Survey was less appropriate in assessing QoL impairment solely by hearing loss.

Since there is an increasing number of hearing loss and its significant negative impact, Chew and Yeak (2010) advocate hearing loss screening, creation of support groups, and routine medical intervention (hearing aids fitting). Studies now have focused on the importance of self-help groups, medical intervention and early

rehabilitation in ensuring maximum benefit for hearing impaired elderly individuals (Weinstein, 1994).

The HHIE-S questionnaire is a useful and disease specific screening tool for hearing loss. Due to the imperfect relationship between physiological and functional hearing loss, Chew & Yeak (2010) suggest the combination of both functional (HHIE-S questionnaire) and physiological (audiometry) assessment, which may give the most holistic evaluation for management purposes.

2.2 Theoretical Framework

2.2.1 Hearing Mechanism

According to Texas Neurosciences Institute (2006), the three portions of the ear, which are the outer ear (external), middle ear and inner ear has important functions in the process of hearing. The outer ear consists of an auricle and ear canal. These structures gather sound and direct it to the tympanic membrane, which is also known as the eardrum. The middle ear is a chamber that connects to the back of the throat, the pharynx, by the Eustachian tube. This tube functions as a pressure-equalizing valve. The middle ear contains the tympanic membrane and three ossicles which are the malleus (hammer), incus (anvil) and stapes (stirrup). These small ear bones transmit sound vibrations towards the inner ear. They functions as a transformer that converts sound vibrations from the external ear canal into fluid waves in the inner ear. Any impairment at the Eustachian tube, tympanic membrane or ossicles may cause CHL. This conductive impairment is usually able to be corrected either medically or surgically.

Texas Neurosciences Institute (2006) explained that the inner ear contains many microscopic hearing nerve endings called the hair cells, which are bathed in fluid. Inner ear fluid waves will cause the delicate nerve endings to move and transmit the sound energy to the brain through the auditory nerve where this sound energy will be interpreted as sound. Impairment to the inner ear fluids or nerve endings may cause SNHL. Usually, this type of hearing impairment is due to a hair cell loss. SNHL usually cannot be corrected through surgery.

2.2.2 Hearing Loss in Elderly

Walling and Dickson (2012) explained that conversation level usually occurs at frequencies of 500 to 3,000 Hz at 45 to 60 dB. At the age of 60 years and above, hearing normally will declines by about 1 dB every year. At 25 dB of hearing loss or more, about 37% of adults aged 61 to 70 years will be affected. Whereas 60% of adults 71 to 80 years of age will be affected by that amount of hearing loss and more than 80% of adults older than 85 years will be affected. Commonly, men will experience greater hearing loss and earlier onset when being compared with women.

2.2.2.1 Age-related Hearing Loss

Age-related hearing loss is also known as presbycusis or elder hearing. Gates and Mills (2005) explained that presbycusis will lead to many consequences, such as decrease of hearing sensitivity and speech understanding in noisy situations, slowed central processing of acoustic information, and failed to localise the sound sources. This will cause hearing impaired people to have difficulty, which is equivalent to the degree of hearing loss, in music appreciation, conversation, involvement in social activities and

orientation to alarms. When comparing normal hearing person with those having hearing loss, those who cannot hear and understand normal speech are more likely to be limited in activity (Ries, 1994).

According to Gates and Mills (2005), hearing difficulty has become a typical social and health problem in view of the high prevalence of presbycusis. Presbycusis will first affect the ability to understand speech. Next, the affected elderly will lost the ability to detect, identify, and localise sounds. Usually, reduction in hearing sensitivity starts from the highest frequencies, which results in difficulties in understanding speech, especially in noisy or reverberant situations. When the loss continues to affect the 2–4 kHz range, needed in the understanding of voiceless consonants such as t, p, k, f, s, and ch, speech understanding will be reduced in any situation.

Gates and Mills (2005) revealed that patient with presbycusis will not complain that they cannot hear, they usually will report that they cannot understand the speech spoken. Although this maybe a minor misperceptions, if it is left untreated, this can cause communication errors or even worse. The hearing loss will eventually affect the lower frequencies through time which will cause poor speech detection and poor speech understanding. Patient may not hear or localise warning sounds that usually composed of high frequency sounds, such as turn signals, escaping steam and beepers. This will eventually leads to disastrous consequences.

As reported by Loh & Elango (2005), Meniere's disease will also cause SNHL. At the early phase it is accompanied with low frequencies hearing loss but as the disease worsens, it causes higher frequency hearing loss. Other examples of SNHL in the

elderly are stroke, intracranial tumour, acoustic neuroma, tertiary syphilis and multiple sclerosis.

2.2.2.2 Conductive hearing loss (CHL)

Other than that, CHL often worsens age-related hearing loss. According to Walling and Dickson (2012), the most common cause, cerumen or wax impaction, may affect hearing loss in up to 30% of older persons. Techniques for removing wax include nonprescription solutions (hydrogen peroxide–based), curetting, prescription cerumenolytics and warm water irrigation. A comprehensive review including studies of 11 different agents concluded that drops of any type appear to bring better outcomes than no intervention, but no specific drop is more beneficial than another. Although warm water irrigation is commonly used, one study showed hearing improvement in only 34% of persons after visually effective irrigation.

Walling and Dickson (2012) also reported that chronic otitis media with effusion or serous otitis media is common in older patients. However, treatment has been evaluated only in children. The short courses of oral steroids or antibiotics may exacerbate serous otitis media. Patients with persistent serous otitis media must be referred for assessment as there is possibility of getting nasopharyngeal carcinoma or another lesion obstructing the Eustachian tube.

2.2.2.3 Untreated Hearing Loss

Hearing loss will have adverse effects on an individual's psychosocial life. According Gates and Mills (2005), if the hearing problem is left untreated, patient may suffers from loss of self-esteem, social isolation and depression. A lot of people treat presbycusis as an unavoidable situation into their future years and are not motivated to find help as they have pride, felt troublesome, and the cost. Others may attribute their problem to mumbling speakers and blame them for speaking unclearly. It is thus a difficult psychological challenge for these people to recognize and accept their age-related impairment.

Gates and Mills (2005) concluded that increasing number of healthcare expenditures has occurs in the management for age related hearing loss as there is a rising mean age of people in the societies nowadays. Although current hearing aids will not bring back lost sensory cells, they do help in providing acoustic power for decreasing metabolic function which helps in communication. The primary management of hearing impaired people in most places usually is done by people who sell hearing aids. There are only about 20% of those with hearing loss who find themselves benefit from amplification will actually bought a hearing aid and 25–40% of them either seldom use or neglect the hearing aid use. Therefore, new treatment and intervention strategies need to be accessed to improve this situation.

2.2.3 Hearing Handicap

According to American Speech-Language-Hearing Association (ASHA) (1981), defining the factors of hearing handicap is a very complex task since hearing impairment itself is a very complex phenomenon. The extent to which hearing impairment is a handicapping condition depends on the interaction of a few factors. It is ideally that any definition of hearing handicap should be considerate of the interrelationship of factors as:

- the present age of the individual,
- the age of the individual when the impairment developed,
- the age of the person when the impairment was first discovered,
- the nature and extent of the hearing impairment,
- the person's communicative needs and the nature of the settings in which communication occurs,
- the relationship of the hearing impairment to other physical or mental impairments,
- the amount and success of rehabilitative treatment already received,
- the individual's reaction and the reaction of others to his or her impaired hearing, and
- the effect of the hearing impairment on the individual's expressive communicative ability.

Until now, there is no one definition of hearing handicap that will adequately meet all the administrative or social program needs of a hearing impaired individual. Thus, it is necessary to define hearing handicap using a variety of ways to clearly find out the particular needs of society's health, education and welfare programs.