



# CONTEMPORARY ISSUES IN HEALTH, EDUCATION AND WELFARE OF PEOPLE WITH DISABILITIES

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## Audiological Management of Age-Related Hearing Loss in Aged Population

# 20

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### Introduction

**A**ge-related hearing loss has been observed as the most common sensory deficit in elderly. As people grow old in life, reduced hearing sensitivity becomes a severe social and other problem, due to degeneration of auditory system occasioned by ageing and other health related factors. This type of hearing loss, most often impair the ability of the aged to maximally benefit from the exchange of information, thus significantly impacting everyday life, causing loneliness, isolation, depression, dependence and frustration as well as communication disorders (Ciorba, Bianchini, Peluchi and Pastore, 2012; Osisanya, 2017).

With increase and advancement in medical and health promotion/preservation, advances in industrialisation and urbanisation, and boost in life expectancy, thus the number of aged population all over the world is increasing tremendously. Therefore, cases of age-related hearing loss have become a growing health-related problem, and this has been observed having capacity to reduce the quality of life. It also impinges on the psychological well-being of the aged, with great adverse effect (social isolation, depression, anxiety and even cognitive decline in the affected persons) on the aged population (Gates, Couropmitree and Myers, 1999). The impact of age-related hearing loss may be



profound, with great consequences on the communication, psychosocial and functional well-being of the people. This condition always makes people who present with it to become defective in daily living communication and socio-emotional functions. In fact, the individual with age-related hearing loss would become defective in activity and functions, to the extent of being incapacitated to enjoy the benefit of normal communication (Osisanya, 2014). The individual may radiate limitations to the effectiveness of normal communication skills as a result of difficulty in understanding environmental speech sounds (Mondelli and Souza, 2012). The difficulty always lead to psychological isolation from the sound environment, limited awareness of auditory sign and signals, little or no appreciation of music, poor concepts resulting from lack of auditory perceptions, frustration and stress (Osisanya, 2014). Thus, poor hearing in the aged population (i.e. people who are above 65 years of age) is always associated with poor physical and psychological functions. Poor functions, due to ageing are the common poor health status among the aged, with evidence of reduced functions; such as reduced mobility, reduced activities, reduced interpersonal relationship and life enjoyment and increased depressive symptoms (Haug and Tang, 2010). Consequently, the aged will experience normal age-related changes in cognition, such as poor working memory and attention, reduction in the speed of information processing and listening ability which may greatly increase their everyday listening challenges. Particularly, when listening in acoustically hostile environments, auditory information may be adversely affected due to central cognitive resources being reallocated to support auditory processing. This may place a substantial demand on executive functions; the working memory component which is responsible for scheduling, organizing and allocating of resources for attending to ongoing activities (Kricos, 2006). In essence, the slower speed rate of information processing, and speech recognition problems always make communication worrisome for the aged population. Therefore communicating in noisy environment such as church



halls, restaurants, parties and public places always make them feel tired.

Hearing loss in aged population always interfere with the conduction of sound vibrations to the inner ear, and their conversion to electrical impulses for conduction to the brain. Also, this condition manifest as a reduction in auditory sensitivity to sound, deterioration in understanding of speech particularly perception in noisy environments, reduced central auditory processing. In fact, the poor communication and functional abilities would be resultant effect, and this leads to decreased quality of life, cognitive decline and depression. It is also imperative to express here that age-related hearing loss is referred to as presbycusis, which is the progressive and irreversible kind of bilateral symmetrical age-related sensorineural hearing loss resulting from degeneration of the cochlea or/and associated of the inner ear and auditory nerves. Presbycusis, which is known as the age-related hearing loss, is a progressive kind of hearing loss, and it is usually bilateral in nature as well as sensorineural kind of hearing loss that occurs in elderly as they advance age (Osisanya, 2013). Presbycusis is a complex and multifactorial disorder which is characterised by symmetrical progressive loss of hearing and capable of influencing multi-factorial process which is determined by a combination of genetic and environmental factors (Ruan, Ma, Zhang and Yu, 2014). The age related hearing loss is observed as the loss of hearing that gradually occurs in most individuals as they grow old in life. Thus, presbycusis is a common disorder associated with ageing and is ranked as the third most prevalent chronic condition in elderly after hypertension and arthritis. The prevalence and severity increase with age, rising from about 30-35 percent of adults aged 65 and older to an estimated 40-50 percent of adults aged 75 and older (WHO, 2012; Shemesh, 2010; Cruikshanks, Wiley, Tweed, Klien, Klien, Mares-Perlman and Nondahl, 1998). Presbycusis is a kind of sensorineural hearing loss which cannot be medically or surgically treated, but could only be rehabilitated through appropriate assistive listening devices (ALDs) to amplify the environmental sound in accordance with the specific type and degree of loss and needs of individual



involved. Presbycusis often occurs in both ears with equal reduction in hearing functions, especially at high pitched sounds. This condition usually affects the perception of high frequency sound due to and caused reduction in auditory sensitivity to sound, reduced central auditory processing and deterioration in understanding of speech, particularly in noisy environment.

Presbycusis is a gradual loss of auditory functions, and people who have the condition may not realise on time that their hearing is diminishing as a result of their advanced age. To this end, presbycusis has been observed as a result of changes in the physiological functions of the inner ear as human being advances in age. It can also occur due to changes along the nerve pathways leading to the brain (Shemech, 2010). Other causes might include intrinsic factors (neuronal loss, loss of cochlear outer hair cells, atrophy of the highly vascular stria in the lateral cochlear wall, oxidative stress, causing DNA mutation and damage, inflammation, metabolic and systemic diseases, including hypertension and diabetes. Extrinsic factors (noise, ototoxic medication and diet), and risk factors (alcohol, cigarette smoking, noise exposure, genetic issues/family history and low socio-economic level). Infection, tumours and tympanosclerosis might also cause presbycusis. Thus, the occurrence of presbycusis is considered to be determined predominantly by genetic factors. However, it can also be influenced by heritability, environmental factors, noise pollution, ototoxic drugs, alcohol, diabetes, hypertension, and damage of mitochondrial DNA (Huang and Tang 2010; Ciorba, Bianchini, Pelucchi and Pasture, 2012; Osisanya, 2013). There are four types of presbycusis occurring in the elderly. These are: Sensory presbycusis (affecting the cochlear hair cells and other supporting cells); Neural presbycusis (which is the loss of afferent neurons in the cochlear); Metabolic presbycusis (affecting the lateral wall and stria vascularis of the cochlear atrophy); and Mechanical presbycusis (appearing as the stiffening of the basilar membrane and organ of corti). Without early diagnosis and treatment of any of these types of age-related hearing loss, presbycusis capable of deteriorating and devastating the quality of life and functional status of the elderly for the



impact of presbycusis may be profound with consequences for the social, functional and psychological well-being of the people affected (Ciorba, Bianchini, Pelucchi and Pasture, 2012).

Presbycusis, like any other types of hearing loss could be classified in line with the three (3) attributes of hearing loss commonly used to describe or explain this disabling condition. The attributes considered are: types of hearing loss (a kind of description, based on the part of the hearing mechanism that is affected); degree of hearing loss (description – based on the range and volume of sounds that are not heard); and configuration (a description in line with the range of pitches or frequencies at which the loss has occurred). These three (3) attributes can be used independently or jointly to classify the evidence of presbycusis as observed in an elderly. Similarly, age-related hearing loss can also be classified according to Shemesh (2010) as conductive hearing loss (which is characterised by an obstruction to air condition that prevents the proper transmission of sound waves through the external auditory canal and/or the middle ear, marked by an almost equal loss of all frequencies). Sensorineural hearing loss (evidence of irreversible dysfunction of the sensory receptors of the inner ear) causing loss of ability to perceive sound, even with greater loss of high frequencies; and mixed hearing loss (evidence of both conductive and sensory dysfunction, due to simultaneous disorderliness of the middle and inner ear mechanism).

Presbycusis is a kind of hearing disorder which is confirmed using a battery of audiologic tests, and measured via proper diagnosis, while the psycho-social effects on those who experience such condition is determined through some psychological measures. The psycho-social effects of presbycusis on elderly range from psycho-social reactions due to auditory deficit, and impaired exchange of information with others leading to a perceived reduction in quality of life (Dalton. Cruickshanks, Klein, Klein Wiley and Nondahl, 2003; Osisanya and Akinyode, 2016). This age-related hearing loss which is one of the irreversible sensorial disabilities has been observed as the most disabling condition on the threshold sensitivity of the auditory



system with observable diminished hearing sensitivity for high pitched sounds by the elderly. In fact, this auditory difficulty varies in severity from mild to substantial loss of functions as age advances, thereby leading to reduced ability to communicate effectively, reduced quality of life, isolation, dependence, and frustration, while at the same affecting the psycho-social life of people around the elderly with the condition. Age-related hearing loss affects approximately one-third of adults between 61 and 70 years of age, and more than 80 percent of those older than 85 years. Men usually experience greater hearing loss and have earlier onset compared with women (Wallhagen, 2010).

### Causes of age related hearing loss

Ageing: is the major cause of this kind of hearing loss and this is a process with three distinct components:

- i. Physiologic degeneration (due to biologic process of wear and tear of the human anatomy and physiology)
- ii. Intrinsic damage (sociococcus): this is the condition of those who have hearing loss attributed to continuous noise exposures, unrelated to their job or occupation. This exposure to these stimuli is frequent, and are often considered common “background noises” that affect the hearing abilities of individuals. Examples of sociococcus-related stimuli are the continuous noises from traffic, home appliances, music, television, and radio. The accumulated exposure to these noises over many years can lead to a condition similar to pure presbycusis.
- iii. Extrinsic damage (nosococcus): with this, age-related hearing loss is observed to be caused by factors which are not noise-based. These include: **ototoxic drugs**: ingestion of ototoxic drugs like aspirin may hasten the process of presbycusis; **vascular degeneration**; **atherosclerosis**: may diminish vascularity of the cochlea, thereby reducing its oxygen supply; **dietary habits**: increased intake of saturated fat may accelerate atherosclerotic changes in old age; **smoking**: is postulated to accentuate atherosclerotic changes in blood vessels aggravating presbycusis;



**diabetes:** may cause vasculitis and endothelial proliferation in the blood vessels of the cochlea, thereby reducing its blood supply; **hypertension:** causes potent vascular changes, like reduction in blood supply to the cochlea, thereby aggravating presbycusis.

**Heredity:** factors like early aging of the cochlea and susceptibility of the cochlea for drug insults are genetically determined.

Oxidative stress

General inflammatory conditions

## Signs and symptoms of age related hearing loss

### 1. Primary symptoms:

- i. Reduced sensitivity to auditory stimuli
- ii. Reduced interpersonal communication/interaction and relationship
- iii. Sounds or speech becoming dull, muffled or attenuated
- iv. Need for increased volume on television, radio, music and other audio sources
- v. Difficulty using the telephone
- vi. Loss of directionality of sound
- vii. Difficulty understanding speech, especially women and children
- viii. Difficulty in speech discrimination against background noise ( cocktail party effect)

### 2. Secondary symptoms:

- i. Hyperacusis; feeling and expression of heightened sensitivity to certain volumes and frequencies of sound, resulting from "recruitment"
- ii. Tinnitus; feeling and expression of ringing, buzzing, hissing or other sounds in the ear when no external sound is present.

### **Impact of age related hearing loss on individual**

Age-related hearing loss would make individual who have the condition to experience disabling effects of hearing loss in middle age and have some financial burden, as well as psychosocial consequences which can mar their health and general well-being. Other effects include the following:

#### **i. Physical Functioning**

Hearing loss is consistently associated with lower self-reported physical functioning and may therefore contribute to a loss of independence. To this end, age-related hearing loss has been observed to have severe impact on activities of daily living (ADLs), such as bathing, dressing, and eating, and instrumental activities of daily living (IADLs), such as using the telephone, doing light housework, even managing money, and energy laundry activities. Longitudinal observations from a population-based sample from Alameda County, California, revealed a greater likelihood of onset of both ADL and IADL disability for adults with a mean age of 65 years who report hearing problems such as difficulty understanding words in normal conversation (Dalton et al 2003).

#### **ii. Health-Related Quality of Life**

The impact of hearing loss on health-related quality of life has been replicated across several population-based studies using different validated instruments. Older adults with audiometrically assessed hearing loss or those who reported communication difficulties or greater social or emotional problems related to their hearing problems (as assessed from the screening version of the Hearing Handicap Inventory) had worse scores on both the physical health and mental health components of the Short Form 36 Health Survey (SF-36). Hearing difficulty, which is ranked third behind respiratory disease and arthritis in negative impact on the physical health component score and second to digestive disorders on the mental health component score. Data from the 2003 Australian Survey of Disability, Aging and Careers showed hearing disability was associated with lower age-specific health-



related quality of life in both physical and mental health scales on the SF-12 quality-of-life survey.

### **iii. Cognitive Functioning**

It has been observed that people with age-related hearing loss always demonstrate reduced cognitive functioning. In fact, a reduced a cross-sectional studies have revealed an association between hearing loss and prevalent cognitive function, and now results from an emerging literature indicate that hearing loss is associated with declining cognitive function. Greater social isolation or increased cognitive demand resulting from age-related hearing loss has also been established in research findings. Alternative explanations such as both conditions resulting from a common neuro-pathologic antecedent or biased ascertainment of cognitive function among older adults with hearing loss have also been confirmed.

### **iv. Family Impact**

Communication difficulty as a result of hearing loss has been known to negatively affect family interaction/interrelationship especially in a shared living environment. This effect would include frustration with communication, avoidance of social situations, and altered home environments due to factors such as increased television volume. Consequent upon this, there will be feeling of anxiety, depression, mood-wing and feeling of unhappiness.

### **Economic Impact**

Aged with experience of hearing loss would constantly be spending income on the continued rehabilitation management of the Assistive Listening Devices (ALDs) and other psycho-social care for improved quality of life.

### **Risk factors**

Several factors have been recognised as contributing to the development of age-related hearing loss. These might be classified into two categories: intrinsic and extrinsic.

Intrinsic factors are host factors primarily related to genetic (including sex and race), health comorbidities (hypertension, diabetes, and stroke).

Extrinsic factors which includes occupational and leisure noise exposure smoking, ototoxic medications, socioeconomic status, and other factors.

## **Rehabilitation (Management) options**

### **Audiological Rehabilitation:**

Hearing loss is the most common sensory deficit in the elderly (Ciorba,

Bianchini, Pelucchi, Pastore 2012). Hearing loss can impair communication, thus creating loneliness, isolation, dependence, frustration and even communication disorders (Ciorba et al, 2012) and when left untreated, hearing loss especially with aged population can substantially impair quality of life. Therefore, the functional capabilities of the auditory system must be assessed on an individual basis due to wide variations in characterizing elderly adults. Chronological age is not a reliable predictor of physical, social, or mental status; thus, it is important to audiotically assess the hearing status of individual. The impact of hearing loss varies by the degree of loss and the individual's personality and activity level. The effects of hearing loss cannot be restricted to pathology alone because the mechanics of the ear cannot be isolated from the social aspects of hearing. The personality effects of hearing loss are largely dependent on an individual's character, including mental, spiritual, societal, and economic resources. These components determine one's reaction to hearing loss and the level of handicap it generates. Based on the aforementioned, audiological rehabilitation of aged with hearing loss must include a comprehensive approach to assessment and a multidimensional intervention. The purpose of auditory rehabilitation with older adults, regardless of the severity or type of impairment, is to assist in recovering lost physical, psychological, and social skills. The entire auditory system undergoes considerable change as the aging process progresses.



Specific conditions may affect the type of aural rehabilitation to provide. For example, older adults develop changes of the outer ear and external auditory canal due to thinning of the epithelium, atrophy of subcutaneous tissue, and decline in secretory abilities of the glands. Hence, certain types of hearing aids or audiological testing may not be appropriate due to changes in the ear structure. Although outer and middle ear pathologies are monitored under the care of a physician, the audiologist should be aware of any such issues. It is important to -related changes in the brain when determining auditory rehabilitation in the elderly population.

### **Use of Assistive Listening Devices (ALDs)**

The use of hearing Aids has become a global practice in rehabilitating individual with hearing loss irrespective of age. A hearing aid is a kind of wearable sound amplifying device that is intended to compensate for rimpaired hearing. The goal of treatment with well-fitted hearing aids is to improve the audibility of even soft speech or music and other sounds while ensuring that sounds do not become uncomfortably loud. Hearing aids can be sophisticated instruments with a variety of customizable features that contribute to their high costs; whether performance improves with higher cost devices is uncertain (Cox, Johnson, Xu, 2014). A variety of non-customised devices, termed“ hearing assistive technologies,” are also available; they include amplified telephones, visual technologies such as captioning, video conferencing, and visual orvibrotactile alerts (Blazer, Domnitz, Liverman, 2016). Hearing aids are non-surgical options for rehabilitating hearing loss, including age-related hearing type.

### **Cochlear Implants**

Persons with severe or total sensorineural hearing loss do not typically benefit from hearing aids, since inner-ear hair cells are would note able to stimulate the auditory nerve in response to sound. Thus, the best rehabilitative options for such individual are cochlear implants, which are surgically implanted devices that bypass the cochlear hair cells to electrically stimulate the auditory nerve, permit partial restoration of hearing and have been shown



to improve speech perception and vocational, social, and psychological functioning (Saunders, Francis, Skarzynski., 2012), as well as the quality of life for adults, including older adults.

### **Otologic Surgery**

Otologic surgery which includes stapedectomy, tympanoplasty and ossiculoplasty of various types have made up the bulk of major otologic surgery for conductive hearing loss. Otosclerosis is usually diagnosed in middle age, therefore, most patients undergo stapedectomy earlier in life. For this reason revision stapedectomy is more likely in the older adult (Langman, Lindeman, 1993; Meyer Lambert., 2012).

### **Communication Strategies**

Several communication methodologies are available to aid the communication (interpersonal relationship) of any individual with profound age-related hearing loss. There are several approaches available through the involvement and use of the sensory organic modalities, which include: Multisensory Approach, referred to as the auditory-global approach. It is the oral or aural ways of rehabilitation or rehabilitation of anyone with communication difficulty. This approach relies on the use of the residual hearing through amplification, as auditory and speech reading training strategies are employed; Acoupedics, based only on the use of audition and early amplification with hearing aids. It emphasizes the use of auditory channel as the means for the development of spoken, receptive and expressive communication skills. The approach is known as unisensory or auditory-verbal method; Cued Speech, which is devised by Cornett in 1967 to aid speech reading and speech development, as it employs eight (8) handicaps in four positions to aid in differentiating among sounds that appear to be same on the lips, e.g /m//h/and/p/; and Manually Coded English, being is devised to enable total communication utilizing signs, residual hearing and speech reading simultaneously. With this approach, language is learned quickly and accurately. This manually-coded English include Signed English (SE) with the application of English grammar, Pidgin Sign English (PSE) with



the use of sign markers to delineate plural and tense and Rochester Method (RM) with the use of visible speech, use of speech, finger spelling (writing in air) to express and receive information.

### **Preventive measures**

Preventive measures such as design of quieter machines, reduction of exposure time, and hearing protection devices are important. For instance, workers who are ageing must strictly adhere to hearing conservation protocols to safeguard their auditory system from being afflicted and this must continue throughout the workers hazardous employment. The use of ear protection by those at risk of occupational exposure, or for leisure-related exposures is generally recommended as a measure of prevention of hearing loss. In fact, with the use of ear protection as a best global practice, the hazards of industrial noise have been reduced over the last four decades with the introduction of hearing conservation regulations, the increasing automation of work, and the shift from noise industrial to quieter information-based economies in developed countries. Although, the risk of noise-induced hearing loss depends on both the level of noise and its duration. This risk could remain high because of recreational and community noise exposures with many young people using personal music players and attending loud music concerts.

Another preventive measure is the use of sound conditioning and drugs such as magnesium and antioxidants; which could help in the prevention of hearing loss. Access to high quality rehabilitation will allow a reduction in disability and an improvement in quality of life.

In addition, preventable causes of hearing impairment such as impacted cerumen (ear wax) in the outer ear, otitis media (middle ear infections), or sensorineural damage due to nutritional deficiencies, noise-induced hearing loss, ototoxicity, and genetic hearing loss from consanguinity could also be encouraged. More importantly, certain life styles must also be avoided or reduced with increasing age to avoid the acquisition of age-related hearing loss.

## Conclusion

Age-related hearing loss is one of the disabling conditions across the globe, due to urbanisation, industrialization and improved communication technologies. It has also been established that unregulated lifestyles (i.e. smoking, clubbing and drinking of alcohol), continued exposure to noise, evidence of metabolic disorders and occupations to promote the accusation of age-related hearing loss. This age-related hearing loss has the capacity to cause a lot of health, economic, and psychosocial problems, but it could be prevented or rehabilitated through a comprehensive audiological and non-audiological measures. Above all, the elderly individual should be on good diet, appropriate leisure and recreational activities, and regular medical check-ups. These are the possible effective measures towards enjoying healthy life as aged population.

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