

# Effect of hearing loss on elderly population: A Literature Review

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## Abstract

“Hearing loss” refers to a condition where a person’s hearing ability or hearing sensitivity is fully or partially lost. According to World Health Organization (WHO) a person is said to be suffering from hearing loss when he or she is not able to hear or has hearing threshold of 20 dB HL or better in both ears. Hearing impairment can be caused due to various reasons among which ageing is an one of important cause, Aging make a person susceptible to hearing loss. 25% of the population above 60 years of age are found to have hearing loss (WHO 2021). The purpose of this review is to identify the impact of hearing impairment in the life of elderly population, In this review 43 papers were analysed, which was published within the time span of 2001 to 2022 Pubmed, Google scholar and epub. Analysis and result of Publication indicates Dementia, impaired cognitive ability, Social isolation and depression were found to be the major effects of the impaired hearing ability of elderly persons.

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## I. Introduction

With ageing a lot of health issues are experienced by human. Hearing loss is one of the common consequences of ageing. The very first work on independence relationship between hearing impairment and cognitive dysfunction by age related hearing loss (ARHL) was by Uhlmann et al. (1989). The study suggested that ARHL may be one of the factors behind dementia ARHL is the third most prevalent condition after hypertension and arthritis in USA (Collins J.G, 1997). A lot of focus is being turned on to the effect of hearing loss on elderly people nowadays. Many clinical evidences supported the fact that decline in communication ability which affect the quality of life is one of the results of age related hearing loss (ARHL). ARHL affects the quality of life, communication capability, mental health, societal relationship, motor skills of a person (Ferri et al, 2011; Bernabei et al, 2005; Ohta et al, 1981; Tay et al, 2006; Thomas et al, 1983; Fetoni et al, 2013; Pichora et al, 2003; Nelson et al, 2006). Fortunato et al in 2016 commented that there are few studies which prove that hearing rehabilitation can alter the natural history of dimension but many studies reveal that hearing loss with age results in dementia and also impaired social interaction leading to social isolation. (Lin et al, 2013; Giroto et al, 2004; Plassman et al, 2007; Jorgensen et al, 2014; Peelle et al, 2011; Chang et al, 2004; Bamiou et al, 2001; Grimes et al, 1985; Nelson et al, 2006). The purpose of the review is also to point out whether ARHL’s effect improves when hearing aids are introduced to the affected person.

## II. Method

### Search Strategy

The literature review was conducted to explore the impact of ARHL. Data bases like PubMed (2012 to 2022), Google scholar (2012 to 2022) and EPUB (2012 to 2022) was searched with keywords “age relating hearing loss”, “ARHL”, “dementia”, “cognitive ability”, “social isolation”, “depression”. Filter was applied for 2012 to 2012 in different databases. All the full text articles where research relevant to the topic.

### Selection criteria

The selection process of the studies followed the specific criteria

- 1) Original papers published in last 15 years.
- 2) The papers where the suggested effects were examined independently and also in combination.
- 3) Full text articles where included.

The exclusion criteria were as follows,

- 1) Thesis.

2) Ongoing clinical trials.

### **III. Results and Discussion**

A combination of factors were found effecting the incidence of ARHL which includes genetic factors (Karlsson et al, 1997; Christensen et al, 2001; Friedman et al,2009). Environmental factors such as exposure to industrial chemicals, recreational noise exposure (Helzner et al, 2005a; Fransen et al,2008; Clark et al,1991)as well as smoking, alcohol consumption, cardio vascular diseases, Type II Diabetes mellitus (Nomura et al, 2005; Fransen et al, 2008; Frisina et al,2006; Popelka et al,2000). Several studies correlated ARHL with different disabilities like cognitive impairment, dementia, depression, social isolation and impaired physical activity.

#### **Depletion of cognitive reserve and Dementia**

Longitudinal (Jayakodyet al, 2018) a as well as cross sectional studies(Deal et al,2016) provided evidence to prove association between hearing loss and cognitive impairment in adults similarly,ARHL has been found associated with risk of dementia (Gallacher et al, 2012; Gurgelet al, 2014; Deal et al, 2016). Suet al, 2017 conducted a cohort study consisting of 4108 patience with ARHL and the control cohort 4013 patients without ARHL, which suggested that ARHL can be regarded as one of the early characteristics of dementia.

The association between dementia and ARHL can be assessed through two different ways one by the way how ARHL effect dementia and other by the common causes behind the dementia.Difficulty in auditory perception increases the cognitive load (Ronnberget al, 2013).Studies have proved that person with hearing impairment devote more neural resources to facilitate hearing process than any other cognitive functions (Pichoraet al, 2018).The hearing loss effect cognition and was found to affect long term and semantic memory than short term memory like attention, fluency, reasoning and working memory (Loughreyet al, 2018).It was also suggested in the study by Loughrey et al. in 2018 that ARHLdevelops from high to low frequency as one ages which can be related to considerable decrease in immediate recall and processing speed of aged people. Another 5-year international longitudinal study by Sarant et al, 2019 showed that with cochlear implant the conditions related to ARHL, such as cognitive function improved which in points towards a direct association with ARHL and increased cognitive load. This increased cognitive load in turn causes brain structural changes and neuro degeneration in the aging brain (Stahl et al, 2017; Lin et al 2014).There are a lot of common factors which affect the ARHL and dementia.Vascular dimentia is an effect of vascular brain injury including stroke which is more common among patients of Alzheimer's disease and on the other hand an association was found between stroke and ARHL (Gopinath et al. 2009).Other factors like smoking, diabetes and atherosclerosis were found common to both dementia and ARHL (Livingston et al, 2017; Lourenco et al, 2018; Lim et al,2016; Wolters et al,2018; Chang et al, 2016).APOE  $\epsilon$ 4 allele was found associated with both dementia and ARHL(Kurniawan et al,2017; Mener et al,2016).Several are the genetic factors like mitochondrial DNA deletion, oxidative stress and RNA oxidation where found also associated to dementia and ARHL(Someya et al, 2010; Kamogashira et al, 2018).Several studies suggest that verbal cognitive measures maybe an over estimation for determining the level of cognitive impairment therefore nonverbal cognitive measures must be or could be used for older persons who are susceptible to ARHL(Fry et al, 2016; Van Engen and McLaughlin, 2018).Few studies have also reported positive association between cognitive impairment and peripheral hearing loss. ARHL as a cause of dementia is a new area to look after. It was not recognised until Livingston et al, conducted research about dementia prevention and intervention and 2017 Some relevant cohort studies have proved that hearing loss affects or hearing loss can be an independent risk for dementia.The cohort studies have proved that hearing loss among the many other causes has proved to be one of the most effective factors behind dementia it has been proved in a study by Livingston et al, 2017.The reason behind the relationship between ARHL and dementia is not clear but several studies indicate that there may be some relationship between dementia and ARHL.As there is a wide variability and subjectivity in the correlation between what is the cause behind the relationship between ARHL and dementia is not clear. It is also not clear as the existing literatures are correlational and also the process of assessment of the relationship of cognition and dementia is variable. there is a limited way of hearing is typically cyst in epidemiological studies shown that the disturbance or the conditions where auditory perception is affected such in case of hearing loss individuals load of cognitive performance work (Pichoraet al, 1995). Ronnberget al, 2017 conducted to cohort study consisting of 4108 patients with ARHL and the control cohort of 4001 participants without any hearing impairments which suggested that ARHL can be regarded as one of the early characteristic of dementia.

#### **Depression and social isolation**

With age individuals become more susceptible to a variety of ailmentsARHL is one of the most common disabilities that grows with age.Hearing loss make it difficult for individuals to interact with other people as they feel uncomfortable to respond in an interaction with impaired hearing, Gradually there is a tendency noticed among the individuals with ARHL to isolate themselves from family, society.leading to

depressive symptoms. There are very few studies that establish a relationship between hearing loss and depression. A mixed result has been noticed while finding out relationship between ARHL and depressive symptoms such as social isolation. One such cross sectional study conducted by Paul et al in 2014 on adults of 62-84 years old adults from 1999 to 2006. This study was conducted on the cycles of National health and nutrition examination survey found that social isolation was one of the dependent variable of ARHL. While the other by Gopinath et al 2009 shows a relationship between mild hearing loss and depression where as no relationship with moderate and severe hearing loss. In a study by Brewster et al, 2018 found that ARHL and depression are directly proportional on the contrary and other study by Acaret et al 2011 found no association between self reported hearing loss and depression. But most of the studies pointed towards ARHL and depression or symptoms of depression like social isolation.

Brewster et al, 2018 conducted a longitudinal study on 3075 participants for 10 years span this study suggested that ARHL might be associated both longitudinally and cross sectionally with depression, but use of hearing aids did not have any effect on the depression trajectory after adjusting all socio demographic factors like age, gender and education

Communication gets impaired with ARHL as hearing is one prime component of communication. As discussed before individuals with ARHL tends to isolate themselves from the society as they find it difficult to take part in social activities social gatherings etc. Social isolation on the other hand is highly correlated with depression. ARHL has been related to dementia which in turn aggravates condition of depression, and poor quality of life. (Luo et al 2012; Berkman et al, 2000). In a longitudinal study on 3075 aged individuals 70 to 79 at base line data from Health aging and body composition study were examined which suggested that ARHL was associated with increased depressive symptoms (Brewster et al 2018). ARHL was also related with tinnitus which when chronic can cause depression, which on the other hand may be as severe as suicidal attempt. Common neural mechanism behind depression and ARHL prove their association. In depressed patients reduction in activity of different lobes of brain like temporal, cerebellar, insula and occipital was noticed in different MRI based studies, which was common in brains of individuals with ARHL. This also proves contribution of ARHL on the depression of elderly people. (Peng et al, 2011; Guo et al, 2011).

#### Physical activity and quality of life

Healthy aging is known to be associated with optimal level of physical functioning where as several longitudinal studies have suggested mixed result about ARHL's association with physical functioning. Some indicated positive association of ARHL and disrupted physical activity where as some denied (Lin et al, 2011; Lin et al, 2011, Lin et al 2013, Tun et al, 2009). With problem in hearing, elderly people are observed to be less interested in physical activity. Walking disability, disinterest in daily activities, slow gait is frequently observed in them. They often get fallen (Tun et al 2009). Chen et al, 2015 reported that hearing impairment was associated with poor physical functioning in older adults and also an increase percentage of risk of incident disability and requirement of nursing care in women. In contrast a review by Woollacot et al, 2002 commented that there is no significant association between hearing loss and physical activity. Sakurai et al 2021 did a retrospective cohort study on 810 community dwelling older adults and found that poor gait performance may modulate the effects of ARHL which leads to cognitive decline and falls. Kuo et al 2021 tried to find out whether there is an association between hearing loss and physical activities the cognitive load in individuals which turn affect the mental health and leads to depression and symptoms of depression like social isolation which can also cause loss of interest in physical activity (Lin et al, 2011; Lin et al, 2011, Lin et al 2013, Tun et al, 2009; Gates et al 2015; Genther et al, 2015) and maintain posture and balance (Shumway-cook et al, 2000) it was evident from the studies that neural degeneration with age can result in ARHL, deteriorated function of vestibular organs resulting in poor balance and control in (Karpa et al, 2010).

A strong association of ARHL was found with dementia, Impaired cognitive ability, social isolation and depression. Though some missing links are there all the effects were found to be interlinked as all of them had neural degeneration with age as common cause. Most of the studies suggested for future research on impact of intervention or cochlear implants on the effects related to ARHL.

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