



# IFE JOURNAL OF BEHAVIOURAL RESEARCH

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Department of Educational  
Foundations and Counselling,  
Obafemi Awolowo University, Ile-Ife

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## EVALUATION OF AUDITORY PERFORMANCE OF THE AGED ON SPEECH DISCRIMINATION SKILLS IN SOUTH-WEST, NIGERIA

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### ABSTRACT

*As age increases, word recognition and speech discrimination ability systematically decreases, in relation to decline along the auditory systems leading to a reduction in the ability to perceive high pitched sounds and discriminate speech correctly. Thus, this study evaluated the performance of two categories of aged on speech discrimination skills. The study was carried out through Pure-Tone Audiometric Test (PTA) and Speech Discrimination Test (SDT) based on phonetically balanced words. Two hundred and forty (240) aged comprising two groups of one hundred and twenty (120) each of rural and urban dwellers were selected using purposive sampling technique. With the aid of independent t-test statistics at 0.05 level of significance, the findings revealed a significant difference in the hearing sensitivity between the aged in rural and urban areas across the pure-tone audiometric tested frequencies ( $t_{cal} = 4.20$ ;  $P < 0.05$ ). The aged in urban area had a significantly better performance on the speech discrimination test than their counterparts in rural area ( $t_{cal} = 3.78$ ;  $P < 0.05$ ). The study found no significant difference in the performance of the two groups on speech discrimination test in line with their gender make-up ( $t_{cal} = 0.57$ ;  $P > 0.05$ ). Based on the findings, the study establishes that the two categories of aged demonstrated poor speech discrimination abilities as a result of their reduced hearing efficiency as a consequence of ageing. Recommendations were therefore made to the aged and their family, society, rehabilitation experts (support services) and government on the need to sharpen the aged verbal/non-verbal and interpersonal oral communication abilities as well as to curtail the explosion of hearing disability as a result of ageing in Nigeria.*

**KEY-WORDS:** *Auditory performance, ageing, speech discrimination skills, communication, rehabilitation*

### INTRODUCTION

Communication is an essential act of human life, and hearing is one of the sensorial tools needed for the daily living communication and socio-emotional functions. For a better communication and interpersonal relationship, the hearing organ needs to be perfectly functioning. Once this sensorial tool is defective in activity and functions, the individual concerned would be incapacitated to

enjoy the benefit of normal communication. The individual may radiate limitations to the effectiveness of normal communication skills due to difficulty in understanding of environmental speech sounds (Divenyi & Haupt, 1997; Marotta, Marone & Quintero, 2002). This difficulty always lead to psychological isolation from the sound environment, limited awareness of

auditory signs and signals, little or no appreciation of music, poor concepts resulting from lack of auditory perceptions, frustrations and stress (Mindel & Vernon, 1991).

Communication difficulty as a result of defective hearing organ has been observed overtime to be as a result of manifestations of physiological changes along the auditory system. In fact, these changes always occur along the human's internal and external structures, as a result of some influencing factors and conditions, as they make the individual vulnerable to internal homeostatic imbalances or environmental insult which may pose a threat to the survival of humans (Barker, 1998). The changes often occur later in the life of humans because of the natural age-related changes in body system functioning (Herbert, 1992), and could be characterized as the loss of ability to discriminate sounds perfectly due to retro-cochlear deafness (Okeowo, 2004).

It is important to know that as human beings grow the balance of the body changes. Some tissues become deteriorated; bone disposition and re-absorption dis-regulated, human joint and movement become less fluid, as it requires more effort. The respiratory structures suffer restriction in ability to expand and contract. Breathing becomes difficult as sight becomes dull. And, there is a steady loss of cerebral cortical neurons leading to diminished sensory motor and associative control (Bennet & Ebrahim, 1995). More importantly, a lot of the observed changes have been noticed to occur along the auditory pathways as a result of ageing. The changes may be accompanied by alterations in the perception, recognition and discrimination capabilities of the auditory organs along some speech

frequencies (Coser, Costa, Coser & Fukuda, 2000). Therefore, the transmission of sound and its conversion to electrical impulses for conduction to the brain may become impaired.

The physiological consequences of ageing along the auditory system is manifested as presbycusis, which is the effect of ageing on the threshold sensitivity of the auditory system with observable diminished hearing sensitivity for high-pitched tones, beginning in the fourth decade of human life (Brown, 1990). It is a type of hearing-loss peculiar to aged, and manifested by the loss or reduction in the ability to understand speech especially in difficult listening condition. This condition is referred to as sensory-neural hearing impairment in elderly individuals resulting from the degenerative changes in ageing. It involves bilateral sensory-neural hearing loss, worse at high frequencies which is associated with difficulty in speech discrimination and central processing of information (Ogunleye & Labaran, 2005). Presbycusis brings about a decreased sensitivity, and influences in the overall audibility of certain speech sounds, in addition to reduction of overall signal level, especially for high frequency sounds and great observable distortion in frequency and intensity (Quintero, Marotta & Marone, 2002). There will be evidence of age-related decline in speech perception and poor discrimination as a result of peripheral sensory and cognitive problems due to ageing (Aydelott, Loech & Crinion, 2010). Consequently, ability to perceive speech sounds will become impaired due to effect of ageing on the central auditory processing (Snyder, Pasinski & McAuley, 2011; Martin & Jerger, 2005). According to Ogunleye and Labaran

(2005), presbycusis has been found to affect both male and female subjects equally, with the onset from the fourth decade of life in the environment. The stria (metabolic) type of presbycusis, mostly presents with moderate to severe sensori-neural hearing loss (SNHL), and constitute an important problem in the society as it occurs in an elderly population that relies on their special senses to compensate for other age-associated disabilities.

With this type of hearing difficulty, the aged may develop reduced ability to recognize or identify meaningful speech sound, regardless of the conditions in which they are presented (Marotta et al., 2002). They always find it difficult understanding spoken speech in prepositional noise or with presence of competing messages. Most times, they show age-related decline in functions of hearing with profound impact upon the verbal and non-verbal communication skills, due to impairment of pure-tone thresholds, (e.g., higher frequency ranges), impairment of speech discrimination, particularly in the intelligibility of monosyllabic words, and decreased ability to distorted speech (Jerger & Musiek, 2000; Araujo, 2002). According to Gordon-Salant (2005), the aged always show experienced difficulty understanding speech in poor acoustic environments, even when they are compared with matched hearing sensitivity. Also, they exhibit abnormally poor performance on duration discrimination tasks, which is highly related to deficits on recognition of reverberant speech, while ageing is accompanied by changes in processing the temporal characteristics of acoustic stimuli. These temporal processing problems always contribute to the speech perception problems of elderly listeners in

degraded acoustic environments. With this, older people have particular difficulty on speech recognition tasks and temporal processing tasks that increase stimulus and task complexity. Poor hearing in aged is equally associated with poor physical and psychological functions, which include reduced mobility and activity, reduced interpersonal relationship and life enjoyment, and increased depressed symptoms (Surman, 1998). As a result of this, the aged always complain of not hearing the presented speech sounds or enjoy interpersonal oral communication because most of the presented words may not be received or distorted in appearance.

Prior to this time, several studies on presbycusis made exploration on the influences of hearing disorders through the use of a large audiometric data. Some of the studies gave general information on hearing insensitivity in old age, while some documented the implications and effects of ageing on the auditory functions. For instance, it has been found that hearing loss in older adults has negative influence on their quality of life (Dalton, Cruickshah, Klein, Wiley & Nondal, 2003). But, generally, none of these studies considered the effects of ageing on the auditory performance and temporal processing functions of the aged in a developing nation such as Nigeria. Consequently, this study was conducted to evaluate the auditory performance of the aged in both rural and urban setting of Nigeria, because of the fact that most aged in our society battle with impaired speech reception and speech discrimination thresholds at all time. As well, there has been a high complain due to the complexity of the aforementioned conditions (presbycusis) and the developing nature of our society, in terms of rehabilitation and materials



available. Unlike the aged in the developed countries of the world with varied access to better rehabilitation and medical services, quiet (conditioned) background conditions, in addition to distraction free environment so as to foster optimal communication benefits; here in Nigeria, many aged with presbycusis were not getting the full rehabilitative attention, due to a number of factors ranging from the developing nature of the rehabilitative services to poor implementation of public laws.

Thus, this paper sets to evaluate the auditory performance of the aged population in relation to speech recognition and discrimination skills. And, to examine whether differences in environmental background and gender would bring about differences in the relative performance of auditory systems on pure-tone audiometric, and speech discrimination skills.

For the purpose of this study, the following hypotheses were tested at 0.05 level of significance:

1. There is no significant difference in the hearing sensitivity of the aged in the urban and rural setting across pure-tone audiometric test frequencies.
2. There is no significant difference in the performance of the aged in the urban and rural setting on speech discrimination test.
3. There is no significant difference in the performance of the participants on the speech discrimination test based on gender difference.

### **Method**

An ex-postfacto research design was adopted for the study. The study only observed the dependent variables without manipulating the independent variables,

which had already occurred before the commencement of the research. Two hundred and forty (240) aged comprising 2 groups of one hundred and twenty (120) each of rural and urban settlers were involved in the study. The participants were selected from Lagos, Ogun and Oyo States, Nigeria, using purposive sampling technique. The two groups (rural and urban) had gender consideration of same equal representation, and were between 60 and 85 years of age. The two sampled groups were subjected to physical examination, clinical otoscopy, pure-tone audiometric evaluation, speech discrimination exercises and filling of a test scale so as to ensure the inclusion of each of the participants.

The instruments used for the study were varied and many. A standardized research scale with the reliability co-efficient of 0.86 was used to elicit responses from the participants. The research scale contained information on personal data; residence; medical history; and personal habits. The scale served as a standard to determine the inclusion of those who fit into the study. Sound level Eagle 120dB Meter calibrated acoustically to JIS (dB) "A" specification was used to measure the noise-level generated in the two study areas. Clinical Otoscope the Welch Allyn 29000 was used to examine the ears of the subjects prior to audiometric assessment, while a diagnostic Audiometer Amplaid A137 useable in line with the British Standards (BS. 2497: 1988) and International Standards Organisation's specification (ISO 389; 1985) was used to assess the hearing acuity of the aged. A pure tone stimulus was generated within the machine and projected out via a set of earphones (DH39, with MX 411 AR type cushions). The Audiometer has already been biologically and technically

calibrated to establish appropriate and reliable hearing thresholds. The researcher made use of 25 words drawn from the first and second list of the CID W-22 word series to evaluate the participants' speech discrimination abilities. The words were pronounced by the researcher at their normal voice level thrice at interval of five (5) seconds after which the participants were expected to reproduce the words or show the flash cards of the words pronounced.

In conducting the study, the researcher approached all the available aged to answer items on the scale to determine their likely inclusion for a broad assessment. The aged individual who satisfied the inclusion phenomena were subjected to a thorough physical examination and clinical horoscopy. Thereafter, Pure-Tone Audiometric (PTA) test of Air/Bone conduction measurement was performed on each of the participants. The test was conducted sequentially on individual in an audiology clinic for those in urban area and in a relative noise-free room with a background noise of 40 dB (A) for those in rural area. The audiometric thresholds for each of the participants were determined and

recorded on standard audiogram in decibel of hearing level (dB HL).

With the same procedure, the audiometric patterns of each group were taken and analyzed by finding the Mean () and Standard Deviation (Std.) of the hearing threshold as a function of ageing. The pure-tone audiometric threshold measures at 500, 1000, 2000 and 4000HZ were summarized and divided using Llyod and Kaplan (1978), to get pure-tone average threshold for each individual. Immediately, the researcher conducted the speech discrimination test on the participants after the PTA assessment had been conducted. The test was carried out through a matched-list of varied phonetically and systematically balanced words. Audited recordings of the CID Auditory test W-22 for speech discrimination was adopted. On this, the participants were scored in terms of percentage of words a participant hears correctly. Thereafter, the hearing acuity and speech discrimination performances of each of the participants in the two groups were analyzed and tested with the use of independent t-test statistical analysis at alpha level of 0.05.

## Results

**Table 1: Comparison of the hearing threshold across pure frequencies -tone audiometric tested**

Categories	N	$\bar{X}$	SD	t.cal	df	Sig
Urban settlers	120	37.20	7.867	4.20*	238	.000
Rural settlers	120	43.36	8.198			

\* Significant at P < 05

**Significant at  $P < .05$** 

Table 1 above shows the comparison of the hearing threshold of the participants from the two study groups. With the computed t-value of 4.20 which is greater than 1.96 of the critical t-value. The finding indicates that there is a significant difference in the hearing performance of the aged in

the urban and rural areas on the pure-tone audiometry. In fact, with the mean score of 43.36 recorded by the rural dwellers as against 37.20 of the urban dwellers, the aged from rural area had a better hearing acuity and auditory performance than those in the urban area. So, at the 0.05 probability level, the null hypothesis is therefore rejected.

**Table 2: Comparison of the Discrimination Score based on Location**

Categories	N	$\bar{X}$	SD	t.cal.	df	Sig
Urban settlers	120	81.67	7.839	3.78*	238	.000
Rural settlers	120	75.63	9.570			

\* Significant at  $P < .05$

Table 2 shows that the rural settlers obtained a lower mean score of 75.63 when compared with the mean score of 81.67 than that of the urban settlers. This indicates that the aged in urban area had a better performance on the speech discrimination test skills than

their counterparts in rural areas. The result shows that the computed t-value of 3.78, when compared to the critical t-value of 1.96 indicated that there is a significant difference between the performance of the aged in the urban and rural areas on word discrimination skills

**Table 3: Comparison of the Discrimination Score based on Gender**

Categories	N	$\bar{X}$	SD	t.cal.	df	Sig
Male	120	78.17	9.07	.57	238	.568
Female	120	79.13	9.41			

Not Significant at .05 level

From the table 3 above, it could be observed that the female gender recorded a bit higher mean score (= 79.13), but the difference was however not significant. The computed t-value of .57 when compared with the critical t-

value of 1.96 statistically shows a non-significant difference in the performance of the two groups based on their gender make-up. With this, the female may likely perform considerably better than their male counterparts in any geographical

settings, but gender make-up may not likely to significantly affect or contribute to reduced hearing sensitivity and poor discrimination ability of the aged.

### Discussion

Going by the findings of this study, the aged evaluated manifested decreased hearing sensitivity, and showed poor auditory performance and speech discrimination skills, regardless of the environmental conditions of rural and urban dictates. It discovered through the findings that the aged due to their difficulty in speech recognition and processing functions demonstrated reduced perception of sound signals, poor word recognition, and poor discrimination capabilities. Also, they showed reduced hearing sensitivity for high-pitched sounds; and reduced interest or ability to understand speech, especially when the source(s) of sound is a bit far a way or when there is a competing background noise, although the aged in the rural areas were found to have better auditory functional ability and hearing sensitivity than those of their counterparts from urban area. The study clearly supports the general assertion and earlier studies which showed significant structural and physiological changes due to ageing process and that ageing always spark-off deleterious effects on the auditory system of the aged-cohorts, and that the rate as well as effects of the changes appeared be individualized, depending on the physical stress each individual is exposed to; differences in environmental insults; climate and environmental dictates (Osisanya, 2004; Quintero et al., 2002; Marrota et al., 2002; Barker, 1998; Gulya, 1990).

The findings revealed that the aged in the urban area had a better word discrimination efficiency, which might

not be unconnected with their better health status, characterized better conversational level which is strengthened on daily basis via available communication devices (such as telephone interactions, television and radio programmes) and other interactive challenges as a result of environmental dictates (Quintero et al., 2002; Scurfield, 1998). On the contrary, the rural aged had difficulty in understanding and enjoying conversation around them, which is evident in their low response on the speech discrimination skills. And, this happens because of their poor health status and inability to follow conversational cues. Most of them appeared emaciated in look with a clear indication of living on junks and carbohydrates with little or no additional mineral intakes, due to their agrarian lifestyle and practice, ignorance and poor social exposure.

Further investigation revealed that the female gender had a higher mean scores compared to their male counterparts on the speech discrimination skills (See Table 3). This observation corroborates the findings which indicated that the higher word discrimination function of the female gender is due more to audibility, and that the decrease in the maximum word recognition and discrimination by men occurred as a consequence of possibility of neural components and other influences on men as a result of physiological make-ups and observed norms (Ogunleye & Labaran, 2005; Divenyi & Haupt, 1997; Dubno, Less, Matthews & Mills, 1997; Cokely & Humes, 1992; Gates, Cooper, Kannel & Miller, 1990).

The general fall in word and speech recognition skills among the sampled aged is undoubtedly the major effects of reduced hearing sensitivity,

poor central auditory processing of speech and poor speech understanding (Hayes, 1985; Marrota et al., 2002). Therefore, the aged hearing sensitiveness and word/speech discrimination abilities could be stimulated via a comprehensive rehabilitation and psycho-therapeutic services, with the use of sensory capability methods of retrieving and relating previous listening experiences with new experiences through physical ability of encoding and decoding; and the use of several input modes such as auditory, visual and tactile channels in speech discrimination for their daily needs (Scurfield, 1998). This model of rehabilitation would help to remediate the aged as well as quicken the process of development of good listening and temporal processing skills, even with ageing.

#### **Conclusion**

Reduced auditory performance is one of the major problems of the aged nowadays. The aged experience poor hearing sensitiveness, faulty ability to communicate perfectly with others, and inability to understand and make differentiation of what is conveyed to them through hearing. Due to this, they develop reduced ability to understand and discriminate speech perfectly, and reflect social opportunity deficiencies, low self-esteem, disorientation and confusion due to their faulty attention and memory. They equally develop a gradual loss of ability to hear high-pitched sounds as a result of changes in the perception and discrimination of sound signals, and exhibit reduced efficiency in the process of listening and interpersonal interaction.

This study confirms amongst others that human hearing reduces in efficiency and performance as one grows old in life. Also, it indicates that the aged in the rural areas had better hearing

sensitivity than those in urban areas, while those in urban setting demonstrated better performance on the speech discrimination skills. The females demonstrated better hearing performance than their male counterparts.

#### **Recommendations**

Based on the findings of this study, all the aged in the Nigerian society should, as a matter of necessity, be audiologicaly examined, so as to survey the influence of ageing on their hearing efficiency, with the aim of mounting early intervention and rehabilitation services for them. In fact, the aged should be encouraged to seek for audiologic examination once in every six (6) months, while any trace of reduced hearing sensitivity should be rehabilitated early with support of appropriate amplification device and essential therapeutic programmes.

Other body changes in addition to presbycusis should be examined thoroughly and attended to in time, in order to have a reduction in aged-population with sensori-neural hearing impairment.

The aged should be encouraged to enjoy a healthy living with adequate balanced diet, in addition to regular intake of vital food supplements. And, their immediate environment must be devoid of environmental insults such as noise, stress and loneliness.

With the increase in the number of the aged nowadays coupled with reduced assistance from the families, government needs to put in place suitable support services. And, such support services should be tailored towards eliminating or reducing the effects of ageing on the aged.

More importantly, the aged reduced speech discrimination ability

should be remediated through auditory visual discrimination (presentation) mode training. This training shall help in no small way to integrate the individual with the disorder back into the society. And, in order to facilitate their social interactions, their immediate environment must be enriched with continuous daily communication opportunity and exercises.

Both the aged in the rural and urban settings should be encouraged to develop good listening skill and interest in communication via television sets, radio and telephone. For, this will help to stimulate and preserve their auditory organ better.

Finally, the aged must not be left alone for a very long period of time in the day. Having people around them always serves as psycho-therapeutic approach to rule-out the possibility of being lonely and in the state of despair. Also, all questions raised by them must be answered satisfactorily.

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