



## INCIDENCE AND PATTERNS OF HEARING LOSS ASSOCIATED WITH THE CONSISTENT USE OF MOBILE TELEPHONE AMONG ADOLESCENTS IN IBADAN, NIGERIA

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### ABSTRACT

*There has been an increased incidence of hearing -related difficulty due to consistent use of mobile phones, particularly those with multiplicity of functions for continued calls and music playing functions. Thus, this study investigated the incidence and patterns of hearing loss associated with the consistent use of mobile telephone among adolescents in Ibadan Metropolis. The study adopted an ex-post facto research design, sampling 500 adolescents through the use of Hearing and Mobile Telephony Questionnaire (HMTQ). Frequency counts and percentage were employed to answer the three (3) research questions raised. The findings revealed that 84.6% were without hearing loss as against 15.4% of the participants who presented with different degrees and patterns of hearing loss. Forty two (54.55%) were males, while 35(45.45%) were the female participants who presented with hearing loss. 423 participants claimed having normal hearing ability even with the consistent use of mobile phone, while 43 of the participants presented with low-frequency hearing loss at left ear, and 46 participants were found with high-frequency hearing loss at the right ear. Further, it was established that people should be enlightened on the dangers of consistent use of mobile telephone to hearing. Therefore, it is recommended that mobile phone should not be used for a long period of time, even when used for calls, and leisure such as music playing functions. The youths should be dissuaded from continued use of ear-piece during leisure. Also, adolescents should go for hearing assessment on a regular basis so as to detect early any changes along their auditory performance.*

**Keywords:** Adolescents; hearing loss; hearing patterns; noise; mobile phone

### INTRODUCTION

Hearing is the ability of an auditory organ to detect vibrating elements within the environment, which are transmitted via the auditory nerves to the brain for interpretation. Hearing can also be described as the ability to perceive sound by detecting vibrations through the sense of hearing. The human ear plays a very important role in hearing, for it is the main sensory organ of the auditory system which performs the first processing of sounds, and houses all the sensory receptors required for hearing (Boundless, 2016). The human ear is departmentalized into the outer ear, middle ear, and inner ear. These three divisions have specialized functions that work together to allow humans to hear. The human ear is an extraordinary sound-detecting organ of all the organs of the body (Bakare, 2013). Human beings also have the special ability to estimate where sounds originate from, commonly called sound localization. The ability to judge or estimate where a sound originates is dependent on the hearing ability of each ear and the exact quality of the sound (Boundless, 2016).

Structurally, the human ear is a delicate organ and highly susceptible to damage especially when exposed to loud noise. However, hearing loss is classified as conductive or sensori-neural depending on the site of the problem. Conductive hearing loss occurs when there is a blockage along the outer or middle ear, and this can often be corrected surgically, while sensori-neural loss describes a condition in which the problem lies in the cochlea (or inner ear) or in the nerve pathways to the brain. Occasionally, a mixed hearing loss occurs when a person experiences both a conductive and sensori-neural

problem. Hearing loss can be of different degrees, ranging from very mild to profound or total deafness. The categories are based on the results of audiological evaluations.

Hearing loss generally occurs over a particular range of frequencies, and may be described by terms such as high frequency, low frequency or flat, depending on the pattern recorded. However, apart from the three conventional types of hearing loss, there are other classifications of hearing loss based on the causes of the loss, such as Presbycusis, which is a kind of hearing loss caused by old age, and psychogenic hearing loss caused by emotional and psychological factors. Other types of hearing loss include Noise-induced hearing loss (NIHL) which is based on over-exposure to noise (sound), particularly those exceeding 85dB. NIHL can be caused by a one-time exposure to an intense (impulse) sound, such as subjection to loud sounds over an extended period of time (National Institute on Deafness and Other Communication Disorders, 2014). It should be noted that most humans are prone to NIHL owing to industrial activities, traffic, airplanes and concerts ravaging the human environment due to improved human environment and technological advancement. Loud sounds emanating from these sources are not well regulated, especially in the developing countries of the world where noise is a major environmental insult.

Surprisingly, with adequate measure to safeguard lives of people from noise, and attendant effects on hearing in the developed nations of the world, hearing loss, particularly from the use of Personal Music Players (PMPs) and other human activities is on the increase. In fact, exposure to PMPs is alarming, with serious effect on both the psychological and health status of majority of people. For instance, thirty years ago, exposure to noise at work was considered a significantly greater threat to hearing than leisure noise, since then there have been great changes in the patterns of sound exposure (GreenFacts, 2008). But nowadays, due to improved technological functions of PMPs, it has been observed that there is a continuous increase in the number of young people who expose their hearing systems to loud sounds, while work-related noise exposure has become decreased greatly.

According to Year 2010 report on the survey conducted by the Centre for Disease Control and Prevention that people of all ages, including children, teens, young adults and older people are susceptible to NIHL, while approximately 15 percent of Americans between the ages of 20 and 69 have hearing loss, and up to 16 percent of teens (ages of 12 to 19) have reported some hearing loss, which could have been caused by loud noise (National Institute on Deafness and Other Communications Disorders 2014). However, in the last five years there has been a plunge in the sales of PMPs as they are now being replaced by multi-functioning high end mobile phones as these mobile phones also do a lot than serve as a device for communication (GreenFacts, 2008). The music playing function from these communication devices have become sophisticated in the sense that they produce the same decibel of sound and musical quality as instruments used in concerts, parties, and pose as much harm to human health and hearing functions. These devices have become increasingly sophisticated and can play sounds very loudly across a broad range of frequencies, which calls for public health concern.

Mobile phones have become an integral part of the modern day human functions and inter-relationships. Historically, the world's first mobile phone call was made on April 3, 1973, when Martin Cooper, a Senior Engineer at Motorola called a rival telecommunication company and informed them that he was speaking via a mobile phone (Goodwin, 2015), since then the expansion of mobile phone usage in the world has known no bound. The number of mobile phones (cellular) usage worldwide is over 6 billion, with Nigeria ranking 7<sup>th</sup> with 167 million mobile phones and China being the highest user of the device with over a billion subscribers (Global Mobile Statistics, 2015). The proliferation of mobile phone networks has transformed communication in Sub-Saharan Africa (Pew Research center, 2015). Therefore mobile telephony has become

a key towards surviving the rigours of day to day activities, and has indeed become compulsory possession of all and sundry. In general, less developed countries are establishing mobile (cellular) phone technology in preference to the traditional and relatively more expensive, fixed line systems (Godson et al. 2012). In Nigeria, as in most developing countries, the mobile phone has become instrumental to the rapid increase in telecommunications accessibility. Before digital mobile telephony was introduced in Nigeria, in 2001, the country had less than 500,000 lines; today, the story is different with the number of telephone lines in Nigeria put at more than 30 million (Omeruo, 2009). Mobile phone devices have become an essential part of daily life and valuable means of information dissemination since its evolution in the 1990's in Nigeria and in most developing countries (Eserinune, 2015).

Reports suggest that mobile phone use can cause health problems like fatigue, headache, dizziness, tension, and sleep disturbances; however only limited research data is available in medical literature regarding electromagnetic fields emitted by mobile phones and auditory function and the possible impact on hearing (Al-Dousary, 2007). Globally, 16% of disabling hearing loss in adults (over 4 million daily) is attributed to occupational noise, ranging from 7% to 21% in the various sub region (Nelson et al., 2005). However, with approximately four billion users of mobile phones, and with a significant proportion incorporating media playing capability and speakers, mobile phones are among the most popular portable media player on the market and present an emerging health concern in both occupational and non-occupational settings (Godson et al., 2012). Most of the young adults unconsciously expose their hearing system to loud noise or music for long periods of time, without considering the consequences of such habits (Poorasl et al., 2014). Adolescents who access the device tend to have a lot of time to surf through the features of the device, since they are dependent and young adults who use mobile phone for longer period of time listening to music to avoid distractions. Consequently, this exposure becomes a major threat to the perfect functioning of their auditory systems, for these mobile phones are typically positioned close to the head during use, particularly the ear, with attendant effects on auditory function of the users.

With the afore-mentioned consequences of consistent use of mobile phone on the auditory functions, both experimental and non-experimental studies have not provided solid evidence of effects of cell phones on human auditory functions. It is in the understanding of this lacuna that the researchers of this study propose to provide evidence information on the hearing patterns of mobile phone users particularly among the adolescents owing to high rate of usage of these devices among them. Essentially, this study aims at determining the incidence of hearing loss, patterns of hearing loss, and suggests ways of creating awareness on the proper ways to preserve the auditory system, with the increased use of mobile phones.

### ***Purpose of Study***

The main purpose of this study is to determine the incidence and patterns of hearing loss associated with consistent use of mobile telephone among adolescents in Ibadan Metropolis, as well as to identify ways of creating awareness on the dangers of the afore-mentioned social habits.

### ***Research Questions***

The following questions were raised to guide the study:

- (1) What is the prevalence of hearing loss among the consistent users of mobile phones?
- (2) What are the hearing patterns of adolescents who are consistently exposed to sound generated by mobile phones?

- (3) What are the ways through which awareness can be created on the dangers of consistent use of mobile telephone to hearing?

## **MATERIALS AND METHODS**

### ***Research design***

This study adopted the *ex-post facto* research design. This is because the researchers only assessed the existing variables and did not influence any of the variables of interest in this study.

### ***Population***

The main population of the study was adolescents within Ibadan Metropolis.

### ***Sample and Sampling technique***

The sample comprised 500 purposively selected adolescents within Ibadan metropolis. The participants were 30 adolescents sampled within Iwo road area, 50 adolescents from Orita-Challenge area, 70 adolescents living within Sango-Poly area, 50 from Elebu area, 150 adolescents residing within Agbowo and University of Ibadan area, and 150 adolescents were from The Polytechnic, Ibadan. 241(48.2%) male and 259(51.8%) female participants were involved in the study (see table 1), with 193(38.6%) within the range of 10-15 years, while 167(33.4%) participants were within 16-20 years, and 140(28%) participants within 21-25 years (see table 2).

### ***Instruments***

The following instruments were used for data collection:

- (1) Audiogrammes
- (2) Otoscope
- (3) Audiometer - Maico ST 20
- (4) Hearing and Mobile Telephony Questionnaire (HMTQ)

### ***Procedure***

The study is delimited to Ibadan metropolis, southwest, Nigeria. The volunteered participants were informed about the purpose and required procedure of the study and the required procedure. A total of 510 questionnaires were distributed to the adolescents in the selected areas of Ibadan metropolis as earlier mentioned. 10 adolescents declined their interest in the study, while the researchers were trying to seek their informed consent. Thereafter, five hundred (500) adolescents who volunteered to participate in the study returned their completed questionnaires. Prior to this, the researchers explained the content of the questionnaire to the participants. After filling in the questionnaire, participants with indication of reduced auditory performance were audiologicaly assessed to identify and determine their thresholds and patterns of hearing loss. These categories of respondents were subjected to Pure-Tone Audiometric (PTA) assessment. Thus, Air-conduction and Bone Conduction tests were the only audiological evaluation conducted on them having complied strictly with the rules of Pure-Tone Audiometric assessment. Maico ST 20; a brand of Audiometer, which has been well calibrated (in accordance to British standards, International Standards Organisation, and American National Standards Institute specification) and biologically evaluated for efficiency and reliable outcomes was employed to perform the PTA. Data were analysed using descriptive statistics of frequency counts and percentage.

**Table 1: Sex Distribution of Participants**

Sex	Frequency	Percentage
Male	241	48.2
Female	259	51.8
<b>Total</b>	<b>500</b>	<b>100</b>

**Table 2: Age Distribution**

Age(in years)	Frequency	Percent
10-15	193	38.6
16-20	167	33.4
21-25	140	28
<b>Total</b>	<b>500</b>	<b>100</b>

## RESULTS

***Research Question 1: What is the prevalence of hearing loss among the constant users of mobile phones?***

The results revealed that 423 (84.6%) of the participants considered their hearing as good with the use of mobile phone for calls or other listening purposes, while 77 (15.4%) admitted to having difficulty in hearing due to the mobile phone (see table 3). 42(17.4%) participants were males with hearing loss, while 35(13.5%) were females(table 4). 83 (16.6%) of the participants felt a form of uneasiness in hearing with the consistent use of mobile phone, while 442(88.4%) did not experience such difficulty. In essence, majority of the participants were observed having normal auditory acuity, even with the consistent use of mobile phone.

**Table 3: Frequency distribution showing total participants with and without hearing loss.**

Those with hearing loss		Those without hearing loss	
Frequency	Percent	Frequency	Percent
77	15.4	423	84.6

**Table 4: Frequency distribution showing the relationship between gender and consistent - use mobile phone usage on hearing.**

Gender	Those with hearing loss		Those without hearing loss		Total
	Frequency	Percent (%)	Frequency	Percent	
Male	42	17.4	199	82.5	241
Female	35	13.5	224	86.4	259
<b>Total</b>	<b>77</b>	<b>15.4</b>	<b>423</b>	<b>84.6</b>	<b>500</b>

**Research Question 2: What are the hearing patterns of adolescents who are consistently exposed to sound generated by mobile phones?**

423(84.6%) participants were observed having normal hearing pattern at both ears, even with the use of mobile phone. While 14 (2.8%) participants were observed having low-frequency hearing loss, 17(2.8%) participants presented with mid-frequency hearing loss, and 46(9.2%) participants presented with high-frequency hearing loss at the right ear. At the left ear, 423(84.6%) participants presented with normal hearing pattern, while 43(8.6%) participants presented with low-frequency hearing loss, 22(4.4%) participants had mid-frequency, and 12(2.4%) had high-frequency hearing loss(see table 5). Also, 46 participants had high-frequency loss at their right ears, as against 12 participants who presented with left ear high-frequency loss, based on the audiometric findings. It was also observed that majority of the participants had difficulty with low-frequency sounds based on their left ear functions.

**Table 5: Distribution showing patterns of hearing threshold of participants who complained of hearing complications after mobile phone usage.**

Pattern of hearing loss	Right ear		Left ear	
	Frequency	Percent	Frequency	Percent
Normal	423	84.6	423	84.6
Low-frequency hearing loss	14	2.8	43	8.6
Mid-frequency hearing loss	17	3.4	22	4.4
High Frequency hearing loss	46	9.2	12	2.4
<b>Total</b>	<b>83</b>	<b>100</b>	<b>83</b>	<b>100</b>

**Research Question 3: What are the ways through which awareness can be created on the dangers of consistent use of mobile telephone to hearing?**

Table 6 indicates the responses of the participants as regards whether to alert users on the dangers associated with the consistent use of mobile phones on hearing. With the result, 75.6% claimed 'Yes', while 24.4% said 'No' to alerting users on dangers of consistent use of mobile phone to auditory systems. As regards whether government should set up a public enlightenment campaign on the dangers of mobile phone on hearing functions, 74.6% supported the assertion, while 25.4% disagreed with the assertion. Further, 61.4% agreed that adolescents should be discouraged from wearing or using headphone/earpiece without adequate control, while 38.6% disagreed that mobile telephone use cannot impose any danger on the hearing functions of adolescents. Finally, 70.8% of the participants supported the assertion that the National Orientation Agency and other public enlightenment agencies should mount up a serious public awareness campaign or education to curtail the reckless use of mobile phone among the adolescents, while 29.2% represented those who felt there is no need for such.



**Table 6: Frequency distribution showing the channels for awareness to the dangers of mobile phone to hearing**

S/N	Items	Response	YES	NO %	Total
1	To alert users on the dangers associated with the consistent use of mobile phones to hearing.	Frequency	378	122	500
		Percentage	75.6	24.4	100
2	Adolescents should be discouraged from constant use of mobile phone.	Frequency	326	326	500
		Percentage	65.2	34.8	100
3	Government should setup a public enlightenment campaign warning against the dangers of mobile phone on hearing functions.	Frequency	373	74.6	500
		Percentage	127	25.4	100
4	Adolescents should be discouraged from wearing or using headphone / earpiece without adequate control	Frequency	307	61.4	500
		Percentage	193	38.6	100
5	The National Orientation Agency and other public enlightenment agencies should mount a serious public awareness campaign or education to curtail the reckless use of mobile phone among adolescents	Frequency	354	70.8	500
		Percentage	146	29.2	100

**DISCUSSION**

***Incidence of hearing loss among the constant users of mobile phones***

Based on the findings of this study, majority of the adolescents sampled presented with normal auditory acuity, while only 77 participants presented with different degrees of hearing loss. The low incidence of hearing loss among the sampled might be due to the rate of usage of the mobile phone, as majority of the participants use the mobile phone for average of 6 hours per day, and occasionally for PMPs due to erratic supply of electricity in Ibadan metropolis. This finding is in line with a similar study conducted by Olaosun, Adetunji and Ogundiran in Osun state, Nigeria in the year 2014, on teachers and health professionals, where only 18.2% of the respondents claimed having hearing problems that were linked to mobile phone usage. Furthermore, the findings of this present study showed that an insignificant number of the participants presented with different degrees of hearing loss. The findings of this research work corroborates the findings of Marques, Filho and Monteiro (2015) in which 11.5% to 15.8% of adolescent users of mobile telephone and phone related accessories tested had hearing loss. Though, the percentage of respondents with hearing problem owing to mobile usage was not significant, the study has been able to establish a link between the use of mobile phone and hearing loss, as 1 in 6 adolescents mobile phone users evaluated presented with hearing loss owing to consistent use of the device.

***Patterns of hearing loss among adolescents who are consistently exposed to sound generated by mobile phones?***

Observed patterns of hearing loss found among the adolescents sampled ranged between low-frequency, mid-frequency, and high-frequency hearing loss. Majority (46: 59.74%) of the participants presented with high-frequency loss at the right ear, as against (12 :15.6%) cases of high frequency loss observed at the left ear. Similarly, 43(55.84%) had low-frequency loss at the left ear, compared to 14(18.18%) who had cases of low-frequency at the right ear. In essence, there were more cases of high-



frequency loss at the right ear. This shows that consistent use of mobile phone for listening or PMPs can cause hearing loss of varying degrees and patterns at both ears. This study is in consonance with the findings of Panda (2007), who found out that people who had talked on cell phones for more than four years are more likely to have high-frequency hearing loss. The participants also presented with varying patterns of hearing loss based on the audiometric evaluation. This finding is also in agreement with the findings of Marques et al. (2015) which states that the hearing patterns of adolescents and young adults exposed to sound generated varies from 7.1% to 23.8% of hearing loss.

***Ways through which awareness can be created on the dangers of consistent use of mobile telephony to hearing?***

Going by the findings of this study, people should be enlightened on the dangers of consistent use of mobile telephone to hearing. As majority of the respondents agreed that mobile phone users should be alerted on the dangers of consistent use to hearing organ. Some of the participants were of the opinion that adolescents should be discouraged from constant mobile phone use. Others advocated that government should setup a public enlightenment campaign against the dangers of hearing, while the National Orientation Agency and other enlightenment agencies should mount a serious campaign to curtail the cases of hearing loss associated with the constant use of the communication devices. This study reiterates the submission of Meo and Al Drees (2005) which affirmed that the excessive use of mobile phone should be avoided and social awareness should be increased through health promotion activities, such as group discussions or public presentation via electronic and printed media sources.

**Conclusion and Recommendations**

The human ear is a vulnerable organ, easily susceptible to damage if not adequately taken care of. Hair cells in the cochlear are particularly volatile to loud sound, particularly when an individual is exposed to it for a long period of time. Among a number of factors causing hearing loss in human, especially among the adolescents and young adults, is exposure to loud sound as well as the wide use of mobile phones for music playing functions and long duration calls. This has been observed posing a serious threat on hearing functions. Therefore, complaints of reduced hearing functions has become rampant nowadays among the youths due to continuous exposure to loud sounds. In fact, consistent use of mobile phones has a deterring effect on human hearing organ, particularly prolonged exposure to the sound generated by the PMPs. Mobile phones and other personal listening devices expose the users to a wide series of health endangering factors apart from hearing loss. From the findings of this study, it can be concluded that employing safe listening culture while using mobile phone can help preserve the hearing functions of mobile phone users. Therefore, there is need for a strengthened effort towards creating awareness on the dangers of the consistent use of mobile phone on hearing pattern and general human health and enactment of stronger laws towards the manufacturing of mobile phones.





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