

## ORIGINAL ARTICLE

# EAR INFECTION AND HEARING LOSS AMONGST HEADPHONE USERS

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The use of headphone has been thought to cause infection in the ear canal and contribute to hearing loss. In this study, we examined 136 Customer Service Representative from Celcom (Malaysia) Sdn. Bhd. who use headphone throughout their working hours. The purpose of this study was to determine the prevalence of ear canal infection and other related diseases of the ear, nose and throat. Their hearing thresholds were also determined using the Amplaid 309 Clinical Audiometer. We found no incidence of infection of the external ear canal amongst the subjects. There were 4 cases of chronic middle ear infection and 4 cases of impacted wax. Hearing impairment was found in 25 subjects (21.2%). However, there was no significant association between hearing loss and the exposure to sound from headphone usage because the high frequencies were not predominantly affected. There was also no association between hearing loss and duration of service.

*Key words : hearing loss, headphone users*

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## Introduction

The use of headphone has been thought to create aural hygiene problems and infection in the ear canal. Not uncommonly the headphone user also express concern regarding the potential for this device to cause noise induced hearing loss. However, documented studies on the side effects of prolonged use of the headphone are rarely described in the literature. Among the prolonged user of the headphone are telephonists, radio deejays and mobile compact personal stereo.

Celcom (Malaysia) Sdn. Bhd. is a major telecommunication company in Malaysia. A total number of 141 customer service representatives are working in the company. Customer service representatives function as telephonists, which uses headphone to receive phone calls from Celcom customer. They work in shift of 8 hours with one-hour break. Therefore, all of them wear headphones and receiving calls continuously for 7 hours. Isolated incidence of ear problems has been reported among

these customer service representatives. It is in the interest of both the employer and the employee that a proper study is carried out to determine ear problems including hearing loss among these customer service representatives.

## Objective

The objectives of this study was to determine the prevalence of infection of the external ear canal as well as other ear, nose and throat diseases among customer service representatives and the hearing threshold level of these subject using Pure Tone Audiometry. The presence of hearing loss in relation to the duration of service was also analysed.

## Methodology

### Population of Study

118 randomly selected customer service representatives from Celcom working in Kuala

Table I: Sex Distribution among the subjects

Sex	No. of subjects (n)	%
Male	40	33.9
Female	78	66.1
<b>Total</b>	<b>118</b>	<b>100.0</b>

Lumpur offices were included in this study from August 1999 to September 1999. The age of the subjects ranged from 18 years to 35 years.

### Hearing Test

Clinical Audiometer machine, Amplaid 309 was used to determine the hearing threshold level of the subjects. Hearing thresholds were investigated in the 250 Hz to 80000 Hz range, which are the frequencies important for speech perception. Results were plotted on the audiogram, which showed the hearing threshold, in decibels hearing level (dB HL) against frequency in hertz (Hz). Audiometric testing was performed using TDH-39 headphones and a bone conductor. Background noise level of the sound proof room was 30dBA.

### Ear examination

All subjects were examined only by the Ear, Nose and Throat Surgeon. Specific diseases of the ear canal were looked for and documented. Examination of nose and throat were also performed.

Table II: Duration of service among the subjects

Duration of service	No. of subjects (n)
1	4
2	55
3	31
4	11
5	9
6	4
7	1
8	3
<b>Total</b>	<b>118</b>

Table III: Disease of the Ear, Nose and Throat

Ear findings	No. of subjects (n)
Impacted wax	4
Active CSOM	2
Chronic Inactive OM	2
Nose findings	No. of subjects (n)
Chronic rhinosinusitis	1
Allergic rhinitis	1
Throat findings	No. of subjects (n)
Chronic tonsillitis	1
<b>Total</b>	<b>11</b>

### Definition

*Hearing threshold* was defined as the lowest intensity level at which multiple representations are detected 50% of the time (1).

*Normal hearing* was defined as having hearing threshold between -10 dB HL to 20 dB HL for all frequencies tested (250 Hz to 8000 Hz).

*Hearing impairment* was defined as having hearing threshold of more than 20 dB HL in at least one frequency.

### Data analysis

The hearing threshold levels for left and right ears were analyzed separately where the hearing impairment among the subjects were determined and the frequencies of sound divided into three categories: low frequencies-250 Hz and 500 Hz, mid frequencies-1 kHz and 2 kHz, high frequencies-4 kHz and 8 kHz

### Results

#### Demographic Data

A total of 136 customer service representatives were analyzed from Celcom Call Centre. They worked on shift duty with an average duration of 8 hours per shift with one hour break.

Table IV : Number of subjects with normal and impaired hearing

Hearing Status	No. of subjects (n)	%
Normal hearing	93	78.8
Impaired hearing	25	21.2

The headphone was used on one ear only that is the preferred ear by the subjects, over 7 hours continuously.

#### Sex Distribution

Table 1 shows the sex distribution of the subjects. The majority of subjects were females (66.1%).

#### Race Distribution

Figure 1 shows the race distribution among the subjects. Majority (91.1%) of them were Malays.

#### Duration of Service

The duration of service among the subjects is shown in Table 2. Majority of the subjects (47%) have been working between 2-3 years with Celcom. The longest duration of service was 8 years in 3 subjects. However, in 18 subjects the duration of service could not be determined. Therefore, the 18 subjects were excluded from the research.

#### Diseases of the Ear, Nose and Throat

A total of 11 subjects were found to have diseases of ear, nose and throat, as shown in Table 3.

Four subjects were found have impacted wax. Another 4 subjects were found to have chronic otitis media. In 2 of them, there were active diseases and the other 2 were inactive. All of these subjects had perforated eardrum.

There was one case each of chronic rhinosinusitis, allergic rhinitis and chronic tonsillitis.

#### Hearing Impairment

The total number of subjects with normal and impaired hearing is shown in Table 4.

There were 93 (78.8%) subjects with normal hearing in both ears. Only 25 subjects (21.2%) were found to have hearing impairment in either one or both ears.

The 25 subjects with hearing impairment were further analyzed. The number of subjects according to ears with hearing impairment in low, mid and high frequencies are shown in Table 5.

The numbers of subjects with hearing impairment in the low, mid and high frequencies were almost equal in the left and right ear.

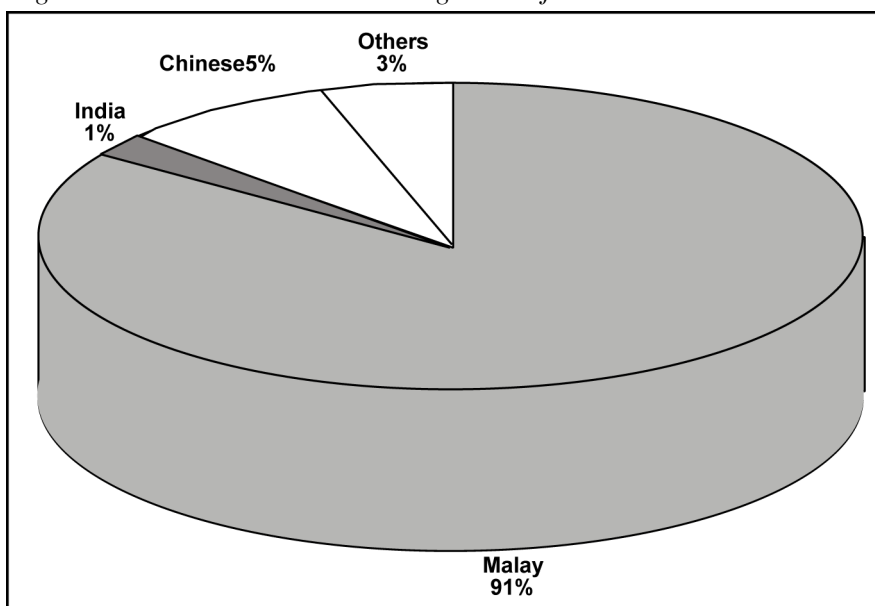
#### Duration of Service among the Hearing Impaired

Figure 2 shows the duration of service among the hearing impaired subjects. The majority of

Table V : Number of ear (left and right) with hearing impairment according to frequency

Frequency	Right Ear (n)	%	Left Ear(n)%
Low (.25 & .5 Hz)	24	20.3	26 22.0
Mid (1k & 2k Hz)	17	14.4	20 16.9
High (4k & 8k Hz)	19	16.1	16 13.6
<b>Total</b>	<b>60</b>	<b>50.8</b>	<b>62 52.5</b>

Figure 1: Race distribution among the subjects



subjects with hearing impairment were in the early years of service (2-3 years).

## Discussion

Documented instances in which headphones used by telephonists have been shown to create aural hygiene problems or are the cause for infections of the ear canal are rarely described in the literature. Nevertheless it is not uncommon for telephonists and other wearers of hearing protective devices to express concern regarding the potential for the headphones to cause ear infection.

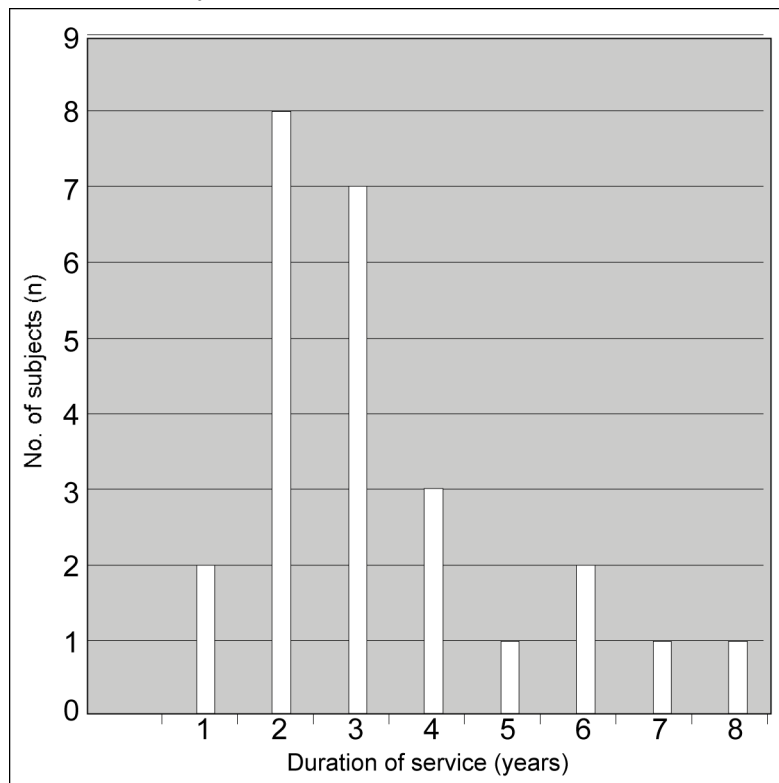
Our study did not show any evidence of infection of the external ear canal amongst the 118 customer service representatives examined by the ENT Surgeons. Observable signs of infection that were looked for in the ear canal include swelling and reddening of the ear canal, discharge and foul odour of the ear canal. Symptoms included itching, pain and tenderness upon manipulation of the pinna and a feeling of fullness in the ear. None of the subjects had any of the above signs and symptoms. However amongst these subjects, 4 were noted to have impacted wax. Since this is a cross-sectional study with no control group, it is not possible to attribute the occurrence of impacted wax due to the use of headphones. This low percentage may represent the prevalence of impacted wax in normal population. Reports of external ear infection or impacted wax resulting directly from wearing headphones are exceedingly rare. Forshaw and Cruchley reported on a study of 60 long range patrol-aircraft crew members wearing earplugs, who were

randomly divided into three groups; one wearing premould earplugs, the second using foam earplugs washed after each used, and (2) the third using earplugs washed only once per week (1). The study lasted 8 weeks and included examinations by medical officer as well as skin scrapping for bacterial culture and fungal examinations. The results indicated no fungal infection or clinically significant bacterial infections and no differences in positive bacterial cultures across the three groups of users. In another study, Cooper reported a study on 587 employees at five mid-western (United State of America) industrial facilities using otoscopy. The subjects were divided into premould earplug users, foam earplugs users and those who did not wear any device. The prevalence of external ear canal infections was less than 0.5% across all groups, with no statistically significant differences among the groups. Cooper also reported data on the presence of cerumen. The prevalence of partial cerumen blockage was 5.0% and total cerumen blockage was 5.1% (3).

Wearing headphones or earplugs has been suggested as a possible predisposing factor for external ear canal infection since their use can increase the temperature and humidity of the canal, create the potential for skin abrasion and provide a vehicle for the introduction of organisms into the canal skin (4). However, as discussed above, our study does not substantiate concern regarding the potential for headphones to increase the likelihood of developing an external ear infection.

We found 4 cases of chronic middle ear infection with perforation of the tympanic

Figure 2 : Duration of services among the hearing impaired subject



membranes. There were 2 active disease and 2 inactive diseases. These were incidental findings. It was most unlikely that the headphone is the cause of the middle ear infection without any external ear canal infection. However, in the 2 subjects with active chronic middle ear infection, they claimed that prolonged use of the headphone on the affected ear may cause itchiness and increased discharge from the ear. This was expected since it has been our experience that the use of ear mould for hearing aids in-patients with chronic middle ear infection would cause such complications. This finding has also been reported in other studies (5).

There was also concern amongst these users of headphones that prolonged use of the device may cause hearing loss. In this study, we examined the incidence of hearing impairment in the left and right ear separately by performing pure tone audiometry. A strict criteria for hearing impairment is used. Hearing impairment was defined as having hearing threshold of more than 20 dB HL in at least one tested frequency. Twenty-five subjects (21.2%) were found to have hearing impairment in either one or both ears. This prevalence was comparable to the prevalence of hearing loss in normal subjects used as controls in other studies (6).

The 25 subjects with hearing impairment in

one or both ears were further analyzed to determine if the hearing impairment was due to noise exposure from prolonged use of the earphone. As one knows, noise induced hearing loss affects the 4 kHz frequency first before further affecting the other frequencies (7). This study did not show higher incidence of hearing impairment in the 4 kHz or other frequencies. In fact the number of subjects with hearing impairment in the low, mid and high frequencies were almost equal. Therefore, it was most unlikely that the use of headphone for a period of 8 hours per shift by these customer service representatives would have any effect on the hearing. This was further strengthened by our findings when comparing the association between hearing loss and duration of service. The majority of the subjects with hearing impairment were in fact in the early years (2-3 years). Thus, the longer the service and therefore more prolonged usage of the headphone does not predispose one to hearing impairment. This finding was expected since the sounds from these headphones are of low intensity. The average measurement of sound intensity from the headphone was found to be 58 dB HL. It was generally below 85 dB HL, which was the threshold above which prolonged exposure of 8 hours or more which may caused a permanent hearing loss.

## Conclusion

In this study, prolonged use of the headphones amongst customer service representatives did not predispose them to infection of the external ear canal. However in individuals who already had chronic middle ear infection, its use could cause increased itchiness and reactivation of the middle ear infection. There was also no evidence of noise induced hearing loss amongst those with prolonged exposure to the sound from headphones and the duration of service.

## Recommendation

Examination of the ear and hearing test should be performed prior to employment, so that a more in-depth study can be done to establish or dismiss the association between the use of headphones and ear infection or hearing loss. Such examination should then be done yearly during employment. This will allow a reasoned approach and help to avoid an overreaction from the employee if they develop any ear infection or hearing loss. It is also useful to suggest regular hygienic wash or cleaning of the headphone in accordance with manufacturer's instruction, to prevent any reservoir of bacteria or fungus that can cause external canal infection. Sharing of headphones should be discouraged.

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