AWARENESS ON NOISE-INDUCED HEARING LOSS AMONG MECHANICAL & MANUFACTURING AND AEROSPACE ENGINEERING STUDENTS IN FACULTY OF ENGINEERING, UNIVERSITI PUTRA MALAYSIA, 2010

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ABSTRACT

Background: Noise induced hearing loss (NIHL) is a preventable cause of permanent hearing impairment due to prolonged exposure to high levels of noise. NIHL can be prevented by avoiding excessive noise and using hearing protective devices. Data suggest that millions of workers are exposed to noise levels that increase their risk of hearing impairment and among these approximately 21-36% are in engineering occupations. This study aimed to determine the awareness and socio-demographic factors among aerospace, mechanical and manufacturing engineering students and the association between the three factors.

Materials and Methods: A cross sectional study was conducted on all students from mechanical and manufacturing, and aerospace department, Faculty of Engineering, University Putra Malaysia. Data collection was conducted by distributing self-administered questionnaire to the engineering students. Data analysis was done by using Statistical Package for Social Science Software Program (SPSS) version 17.

Result: Of a total of 329 students, 285 (86.6%) students responded. We found that 68.8% (n=196) among the respondents had good awareness of NIHL while 14.3% engineering students, suspected to have hearing problem had poor awareness of NIHL. There was significant association between awareness and year of study (p<0.01).

Conclusion: The result demonstrated that engineering students who had good awareness experienced less suspected hearing problem compared to those who had low awareness. There was significant association between awareness and years of study. Therefore, it is important that engineering students should be given education on NIHL and hearing protection measures as early as possible during the engineering course.

Keywords: Awareness, noise induced hearing loss (NIHL), engineering students.
1.0 Introduction

Noise induced hearing loss is the most significant preventable cause of hearing disability. (Peter, 2000). NIHL develops gradually over a period of several years following long term repeated exposure to loud noise. Long-time exposure to the harmful noise cause irreversible damage to sensory hair cells of the cochlea with in the inner ear. These hair cells convert the sound energy to electrical signals and the auditory nerve carries these signals to the brain. (U.S. NIDCD Fact sheet ,2014). Noise induced hearing threshold shift (NITS) is the first sign of NIHL, which appears as a notch in audiometric study which is caused by transient inner ear hair cells dysfunction. (Mahboubi et al.,2013) Although complete recovery can occur from a given episode, repeated such episodes can lead on to permanent threshold shifts because of the irreversible damage to the inner ear hair cells. Avoiding excessive noise exposure halts further progress of the hair cell damage. In the United States about 9 million workers are exposed to noise above levels considered safe (Nelson, 2005). Besides, it was estimated that around 100,000 people are having hearing damage due to prolonged exposure to the noise at their workplace (Health & Safety Executive information sheet, No.26). Approximately 21-36% of these workers are related to the engineering occupations. The economic cost of occupational hearing loss has been estimated to be in billions of dollars. (Kupps and Apps, 2007). NIHL causes tinnitus which in turn lead on to social isolation, depression, increased risk of accidents and reduction in work productivity. (Nelson ,2005; Health & Safety Executive information sheet, No.26; Kupps and Apps, 2007). A study on hearing health practices of forestry and wild life management students shown that despite the basic hearing protection health education, concern about NIHL and use of hearing protective devices remain low (Callagan, Lass and Martinelli, 2014). Various studies shown that the prevalence of NIHL is significantly high among operating engineers (Hong, 2005; Dasgupta, Mana and Sau, 2009). To date there is a paucity of data regarding the awareness of NIHL among engineering students. There are no published data on prevalence of NIHL among engineering students. Therefore, the main objective of this study was to determine the awareness on noise induced hearing loss among aerospace, mechanical and manufacturing engineering students in UPM, Malaysia.

2.0 Materials and Methods

A cross sectional study was conducted in the Faculty of Engineering in UPM, Malaysia. There were eight departments in Engineering Faculty but we only took students from Department of Mechanical & Manufacturing and Department of Aerospace Engineering as our study subjects. Three hundred and twenty-nine students were selected using the purposive sampling method from first year to final year of both courses.

A self-administered questionnaire was used to collect the data from this subject. The questionnaire design divided into four parts; Part I is social demographic factors; Part II is respondents past histories; Part III to determine the suspected hearing problems among the respondents and Part IV to determine the awareness among the respondents. The data was analysed by using Statistic Package of Social Sciences (SPSS) version 17.0. For the descriptive statistic, distribution by frequency and percentage were generated. To analyse the
association, Chi-Square test and Fisher’s Exact test was used because all the data were categorical.

3.0 Results

3.1 Socio-demographic characteristics

The total student in department of mechanical & manufacturing and aerospace engineering was 329 students. However, only 285 students participated in this study. Therefore, the response rate was 86.6%.

Based on their gender, majority of the engineering students were males which consisted 65.6% (n= 187) and the females gender were 34.4% (n=98). For the ethnicity, Malay was the highest respondents, with 49.5% (n= 141), followed by Chinese 43.2% (n= 123), Indian 4.6% (n= 13) and other ethnics 2.8% (n=8). For the course of study, majority (66%, n= 188) of them were from Mechanical & Manufacturing engineering course while 34% (n= 97) were from Aerospace engineering course. For the year of study, there were 23.9% (n=68) first year, 28.4% (n=81) second year, 24.2% (n=69) third year, 23.5% (n=67) final year students.

3.2 Awareness on NIHL among engineering students.

![Figure 1: awareness on NIHL among respondents](image)

Figure 1 illustrates the distribution of awareness among Mechanical & Manufacturing and Aerospace engineering students. Majority (68.8%) engineering students had good awareness on NIHL while 31.2% (n=89) engineering students had poor awareness on NIHL.
3.3 Suspected hearing problem

Figure 2 shows that the distribution of suspected hearing problem among Mechanical & Manufacturing and Aerospace engineering students. 271 (95.1%) students were not suspected to be having hearing problem, while only 14 (4.9%) students were suspected to be having hearing problems.

3.4 Association between gender, ethnicity and Awareness on NIHL

Table 1: Association between gender, ethnicity and awareness of NIH

<table>
<thead>
<tr>
<th>Awareness</th>
<th>χ²</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good ( n ) (%)</td>
<td>Poor ( n ) (%)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>940</td>
<td>0.332</td>
</tr>
<tr>
<td>Male</td>
<td>125 (63.8)</td>
<td>62 (69.7)</td>
</tr>
<tr>
<td>Female</td>
<td>71 (36.2)</td>
<td>27 (30.3)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>5.734</td>
<td>0.125</td>
</tr>
<tr>
<td>Malay</td>
<td>104 (53.1)</td>
<td>37 (41.6)</td>
</tr>
<tr>
<td>Chinese</td>
<td>76 (38.8)</td>
<td>47 (52.8)</td>
</tr>
<tr>
<td>Indian</td>
<td>9 (4.6)</td>
<td>4 (4.5)</td>
</tr>
<tr>
<td>Others</td>
<td>7 (3.6)</td>
<td>1 (1.1)</td>
</tr>
</tbody>
</table>
Majority of students with good awareness were male (63.8%) and of Malay ethnicity (53.1%). Results showed that there was no significant association between awareness on NIHL and gender (p>0.05) awareness of NIHL and ethnicity (p>0.05).

3.4 Association between year of study and awareness on NIHL

Table 2: Association between year of study and awareness on NIHL

<table>
<thead>
<tr>
<th>Year of Study</th>
<th>Good n (%)</th>
<th>Poor n (%)</th>
<th>$\chi^2$</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>38 (19.4)</td>
<td>30 (33.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd year</td>
<td>44 (22.4)</td>
<td>37 (41.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd year</td>
<td>58 (29.6)</td>
<td>11 (12.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th year</td>
<td>56 (28.6)</td>
<td>11 (12.4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Level of significance $p<0.001$

Table 2 shows the relationship between awareness on NIHL and years of study. Majority of students with good awareness were in their 3rd year of study (29.6%) and 4th year of study (28.6%), which is the final year for engineering course. The result showed that there was significant association between awareness on NIHL and years of study ($p<0.01$).

3.5 Association between course of study and awareness on NIHL

Table 3: Association between course of study and awareness on NIHL

<table>
<thead>
<tr>
<th>Course</th>
<th>Awareness</th>
<th>$\chi^2$</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace</td>
<td>Good n (%)</td>
<td>0.037</td>
<td>0.848</td>
</tr>
<tr>
<td></td>
<td>Poor n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical &amp; Manufacturing</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Level of significance $p<0.05$
Table 3 shows the association between awareness and course. Majority (69.1%) students with good awareness were from Mechanical & Manufacturing course. The result showed that there was no significant association between course of study and awareness of NIHL (p>0.05).

3.6 Association between awareness on NIHL and suspected hearing problem

Table 5: Association between suspected hearing problem and awareness of NIHL

<table>
<thead>
<tr>
<th>Awareness</th>
<th>n (%)</th>
<th>χ²</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>196</td>
<td>1.968</td>
<td>0.161</td>
</tr>
<tr>
<td>Poor</td>
<td>89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suspected hearing problem</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>12 (85.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>184 (67.9)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Level of significance p<0.05

Table 5 shows the distribution of awareness on NIHL according to suspected hearing problem. The result showed that there was no significant association between awareness of NIHL and suspected hearing problem (p>0.05). Majority (67.9%) of students who were not suspected to have hearing problems had good awareness of NIHL.

4.0 Discussion

In this study there were 285 Mechanical & Manufacturing and Aerospace Engineering students from Engineering Faculty in University Putra Malaysia recruited. Prevalence of suspected hearing problems among the engineering students were 4.91%. A recent study by Henderson E et al 2011 revealed that the prevalence of noise induced threshold shifts among female youths has increased. Adolescents were at an elevated risk of hearing impairment as early as middle age due to their habit of listening to loud music for hours. A study done by Caldart et al., 2006 described that occupational noise induced hearing loss is mainly observed among aged population after long term exposure, where risky departments identified were industrial engineering, spinning and weaving. Cochrane database systemic review conducted to find out interventions to prevent occupational noise induced hearing loss revealed that there were no studies on engineering controls for noise exposure (Verbeek et al., 2012).

This study showed that from 285 engineering students, 68.7 %( n=196) students had good awareness on NIHL while 31.2 %( n=89) students had poor awareness on NIHL. This is consistent with a study done by Shah et al., 2009 among 94 adults at a university recreation centre in Urbana-Champaign, where people volunteering for this study were aware and concerned about NIHL. However study done by Chung et al., 2005 showed that there was a low level of awareness on NIHL among adolescents and young adults (Shah et al., 2009; Chung et al., 2005)

In this research, there was no significant association between awareness and gender but the proportion of good awareness was higher among males than females. In contrast, a
comprehensive study on the prevalence and risk factors for noise-induced hearing threshold shift (NITS) in the United States adult population based on the National Health and Nutrition Examination Surveys (NHANES) demonstrated that men are at significantly high risk (U.S. NIDCD Fact sheet, 2014).

There was no significant association between awareness of NIHL and ethnic group. In this study, each race was not equally distributed due to the sampling population chosen, whereby majority students were from Malay ethnic group. However study done by Ishii et al., 1998 among 286 individuals from the metal fabricating plant found that the non-white group demonstrated less hearing loss than the white population. The results of this study suggest that occupational noise exposure alone does not alone account for the racial hearing differences.

In this research, there was significant association between awareness on NIHL and years of study in the University. Majority of students with good awareness on NIHL were from the third year engineering students with (29.6%) followed by fourth year with (28.6%), second year with (22.4%), and first year engineering students with (19.4%). Duration of engineering course in this university is 4 years. The third year and final year students had more practical sessions and thus were more frequently exposed to noisy machines. Subsequently, they had more trainings and reminders on hearing protection and NIHL during their course compared to first and second year students.

It was found that there was no significant association between awareness on NIHL and the types of engineering course. Mechanical & Manufacturing students showed a higher proportion of good awareness compared to aerospace engineering students. Due to the nature of their course, the Mechanical & Manufacturing engineering students were more exposed to noisy machinery during their course. Therefore mechanical & manufacturing engineer students had more knowledge regarding NIHL and hearing protection.

5. Conclusion and recommendation

The result demonstrated that engineering students who did not have hearing problems had good awareness on NIHL. There was significant association between awareness of NIHL and year of study in the university. However, there was no significant association between awareness and other socio-demographic factors (gender, ethnicity and type of the course). Since NIHL is an irreversible condition but a preventable disease, it is important that engineering students should be given education on NIHL and hearing protection measures as early as possible during the engineering course.

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Declaration

Authors declare that there is no conflict of interest regarding publication of this article.

Authors’ contribution

Subha ST: Research topic, draft of proposal, coordinate research activities, final manuscript writing.
Huda BZ: Research topic, research activities, manuscript editing.

References


Using MP3 players at high volume puts teens at risk for early hearing loss, say researchers. (December 29, 2011). Science Daily, Source: American Friends of Tel Aviv University.
