Noise-induced hearing loss: Prevalence, degree and impairment criteria in South African gold miners

by

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To Jesus Christ all the glory: Proverbs 2:6 : “For the Lord gives wisdom; from His mouth come knowledge and understanding.”
Abstract

Despite the preventability of noise-induced hearing loss (NIHL) a high prevalence is still reported in South African mines. The study aimed to describe the hearing of gold miners pertaining to the prevalence and degree of NIHL and effectiveness of current RSA impairment criteria to identify NIHL.

The audiological data, collected between 2001 and 2008, of 57 714 mine workers were investigated in this retrospective cohort study. Data was accessed through the mine’s electronic database and exported to Microsoft Excel 2007 worksheets. Participants were categorised in terms of noise exposure (level and working years), age, race and gender. Noise exposure levels were described in terms of a specific occupation and categorized into four groups based on dosimeter data received from the mine’s noise hygienist, namely: 1) Below surface (underground) noise exposure, ≥85 dB A, classified according to the South African regulations on the daily permissible dose of noise exposure, named Noise Group 1; 2) Surface noise exposure, ≥85 dB A, named Noise Group 2; 3) No known occupational noise exposure, named control group; and 4) Uncertain levels of noise exposure, e.g. students and trainees, named Noise Group 4. The control group was matched with participants of noise group 1 and 2 based on gender, race and age at the most recent audiogram test. Descriptive and inferential statistics were employed. Measures of central tendency and variability were used with analysis of covariance (ANCOVA) and pairwise comparisons according to Fisher’s Least Squares Differences Approach (F test).

Results indicated that noise exposed groups had significantly higher prevalence of high and low frequency hearing loss than the control group. High-frequency hearing loss was also present in the control group. The greatest differences in prevalence of hearing loss were observed at 3, 4 kHz and age group 36 to 45 years. Thresholds at 8 kHz were worse than expected and decline slowed down with age. High-frequency thresholds showed a non-linear growth pattern with age with a greater decline at 2 kHz with age in the noise-exposed population compared to the control group. Hearing deteriorated more across age groups with more noise-exposed years, and this deterioration was most visible after 10 to 15 working years and at 3 kHz. Females had better hearing than males across the frequency spectrum. Black males
had significantly better high-frequency hearing than white males but significantly worse low-frequency hearing than white male counterparts. PLH values showed poor correlation (through statistical analyses) with other well-accepted hearing impairment criteria.

To date this was the largest study conducted on the hearing of gold miners and the sample included a very large number of black males exposed to occupational noise (N=17,933). Values supplied in distribution table format are therefore unique and contribute greatly to the knowledge base.

**Key terms:**

Noise-induced hearing loss

Gold mines

Occupational noise

Percentage loss of hearing

Race

Gender

Age related hearing loss

Noise exposure

Prevalence

Degree of hearing loss

Notch
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<td>American Medical Association</td>
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<td>ANSI</td>
<td>American National Standards</td>
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<td>ARHL</td>
<td>Age related hearing loss</td>
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<tr>
<td>COIDA</td>
<td>Compensation for Occupational Injuries and Diseases Act, No. 130 of 1993, South Africa</td>
</tr>
<tr>
<td>dB A</td>
<td>Decibel A-weighted</td>
</tr>
<tr>
<td>dB HL</td>
<td>Decibel hearing level</td>
</tr>
<tr>
<td>dB SPL</td>
<td>Decibel sound pressure level</td>
</tr>
<tr>
<td>DPOAE</td>
<td>Distortion Product Otoacoustic Emission</td>
</tr>
<tr>
<td>HCP</td>
<td>Hearing conservation programme</td>
</tr>
<tr>
<td>HEG</td>
<td>Homogenous exposure group</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>kHz</td>
<td>Kilohertz</td>
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<tr>
<td>MHSC</td>
<td>Mine Health and Safety Council</td>
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<tr>
<td>NIHL</td>
<td>Noise-induced hearing loss</td>
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<tr>
<td>NIOSH</td>
<td>US National Institute for Occupational Safety and Health</td>
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<tr>
<td>OAE</td>
<td>Otoacoustic Emission</td>
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<tr>
<td>OEL</td>
<td>Occupational exposure level</td>
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<tr>
<td>OSHA</td>
<td>The United States Occupational Safety and Health Administration</td>
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<tr>
<td>PLH</td>
<td>Percentage loss of hearing</td>
</tr>
<tr>
<td>PTA346</td>
<td>Pure tone average of 3, 4 and 6 kHz</td>
</tr>
<tr>
<td>PTA512</td>
<td>Pure tone average of 0.5, 1 and 2 kHz</td>
</tr>
<tr>
<td>RSA</td>
<td>Republic of South Africa</td>
</tr>
<tr>
<td>SANS</td>
<td>South African National Standards</td>
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<tr>
<td>SANS 10083: 2007</td>
<td>SANS: The measurement and assessment of occupational noise for hearing conservation purposes</td>
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<tr>
<td>TWA</td>
<td>Time weighted average</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
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