Systematic Assessment of Noise Amplitude Generated by Toys Intended for Young Children
Sepehr Oliaei, M.D.¹ Hossein Mahboubi, M.D., M.P.H.¹ Karam Badran, B.S.¹ Hamid R. Djalianian, M.D.¹

1 University of California, Irvine – Division of Neurotology and Skull Base Surgery, Department of Otolaryngology-Head and Neck Surgery, Irvine, CA

ABSTRACT

Objective: To quantify noise amplitude generated and trend noise levels of toys manufactured for young children over the last several years.

Method: From 2008-2011, over 200 toys intended for children under 5 years of age were screened. The toys with output of more than 80 dB were tested in a sound-proof audiometry booth. The generated sound amplitude of each toy was measured at speaker level and at 30 cm away from the speaker.

Results: Ninety different toys were analyzed. Mean noise amplitude peak at the speaker level was 99.5 dBA ± 8.1 SD (range 80-121) and at 30 cm away from the speaker was 79.7 dBA ± 11.1 dBA (range 60-109). Eighty one (90%) had more than 90 dBA noise amplitude at speaker level while 16 (22%) had more than 90 dBA noise amplitude at 30 cm distance.

Conclusions: Our findings demonstrate the persistence of extremely loud toys marketed for very young children. Acoustic trauma from toys remains a potential risk factor for noise induced hearing loss in this age group and parents should be alerted to this potential public health issue.

INTRODUCTION

• Noise induced hearing loss (NIHL) is the second most common cause of sensorineural deficit.
• Incidence of NIHL in children and young adults has increased in the past decade. [1-3]
• Previous studies of NIHL have focused on occupational noise exposure in adults.
• Recreational and leisure time exposure to hazardous noise could affect individuals of all ages [1,2,4].
• Children are exposed to noise in their everyday activities directly through toys.
• Our study investigates noise level in toys.

METHODS

• Over 200 children’s toys were evaluated over four consecutive years during the months of November to January.
• The toys were selected following in-store preliminary testing using a portable sound level meter (SPL Meter, Studio Six Digital) and re-tested in a soundproof audiometric booth for peak sound levels.
• The toys were labeled for children in the range of 6 months to 5 years and up and produced fluctuating, or impulse sounds electronically.
• Measurements of sound intensity were made in a double-walled anechoic chamber utilizing a portable digital sound meter (Brüel & Kjær, Sound Level Meter 2238 Mediator).
• The meter was programmed to record the greatest amplitude of sound, expressed in dBA, at all frequencies created by the toy.
• The position of the microphone in relation to the toy’s speaker was standardized at a distance of 0 centimeters (cm) and 30 cm for each recording (Fig. 1).
• All of the toys were operated to produce the maximum sound output while producing their fluctuating, or impulse sounds for approximately 20 seconds.

Fig. 1: Positioning the Sound Level Meter 2238 mediator microphone at 0cm distance from the toy’s speaker.

RESULTS

• A total of 90 different toys were analyzed.
• Mean noise amplitude peak at the speaker level or 0 cm was 99.5 dBA ± 8.1 SD (range 80-121) and at 30 cm away from the speaker was 79.7 dBA ± 11.1 SD (range 60-109).
• Eighty one (90%) had more than 90 dBA noise amplitude at speaker level while 16 (22%) had more than 90 dBA noise amplitude at 30 cm distance.
• Detailed results of evaluations stratified based on age group specifications and year of production are presented in Tables 1 and 2.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Total Toys (n)</th>
<th>dB@ 0cm</th>
<th>dB@ 30cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3yo</td>
<td>38</td>
<td>33</td>
<td>99.8 ± 6.7</td>
</tr>
<tr>
<td>&gt;3yo</td>
<td>34</td>
<td>30</td>
<td>99.8 ± 8.3</td>
</tr>
<tr>
<td>&gt;5yo</td>
<td>18</td>
<td>18</td>
<td>101.3 ± 6.9</td>
</tr>
</tbody>
</table>

Table 1: Total number of toys and noise amplitude measurements at speaker level and 30 cm distance of different toys by age group specification.

• One-way ANOVA revealed that there were no statistically significant differences between the results at speaker level from different years (F(3,86)=2.681, p=0.052) or different age group specifications (F(2,87)=0.558, p=0.574).
• The results of noise amplitude at 30 cm distance were not normally distributed.
• Therefore, non-parametric equivalent of one-way ANOVA was used for inference.
• Kruskal-Wallis test revealed a statistically significant difference between 2009, 2010 and 2011 (H(2)=40.03, p<0.001) but there was no significant difference between different age group specifications (H(2)=1.774, p=0.412).

CONCLUSION

• Consistent with prior reports published in the 1990s, we demonstrate the persistence of extremely loud toys marketed for very young children.
• Warning labels must be placed more prominently so as to alert adults to the possible risk factor of acoustic trauma.
• Epidemiologic studies are needed to determine appropriate hearing screening methods and assess the most effective methods of minimizing NIHL in this population.

REFERENCES


Table 2: Total number of toys and noise amplitude measurements at speaker level and 30 cm distance of different toys by year of production.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Toys (n)</th>
<th>dB@ 0cm</th>
<th>dB@ 30cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>17</td>
<td>15</td>
<td>99.3 ± 7.1</td>
</tr>
<tr>
<td>2009</td>
<td>18</td>
<td>16</td>
<td>102.7 ± 9.3</td>
</tr>
<tr>
<td>2010</td>
<td>45</td>
<td>40</td>
<td>100.1 ± 8.1</td>
</tr>
<tr>
<td>2011</td>
<td>10</td>
<td>10</td>
<td>97.1 ± 4.8</td>
</tr>
</tbody>
</table>

*In 2008, only the noise amplitude at speaker level was evaluated.