

Critical Review:

In preschool aged children (0-3years), is there evidence of noise induced hearing loss related to the use of battery-operated age-appropriate toys?

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This critical review examined the effects noise levels emitted from preschool age-appropriate toys had on producing noise induced hearing loss in preschool aged children (0-3years). Overall, research indicates that current preschool aged toys emit noise levels that exceed current regulations and are within a range that may lead to noise induced hearing loss in adults. Research also indicates that children are playing with toys closer to their ears than the distance used in safety regulations. A concrete statement regarding the effect of current preschool aged toys causing noise induced hearing loss in children cannot be made at this time due to absence of research directed to the question.

Introduction

Concerns have been raised regarding current preschool aged toys on the market creating noise induced hearing loss (NIHL) in children.

In order to evaluate NIHL, the intensity of a given noise needs to be assessed in combination with the duration of exposure.

Studies have shown that 10% of cases of children with hearing loss are attributed to noise (Luxon, 1998). Research found that 85% of the toys are unsafe because they emit noise levels in excess of the limits recommended by the World Health Organization (1980) and the ISO (Charbonneau and Goldschmidt, 2004). Another main concern is that children are playing with toys at closer distances to their ears than what the toys are being measured at to pass safety regulations. Field tests have shown that the majority of toys designed for the 0-3 age group are being held closer to the ear than the distance used in the current law's measurement protocol (Charbonneau and Goldschmidt, 2004). Parents need to be made aware of the potential hearing hazards associated with these noisy toys. The danger of excessive noise is invisible unlike small or sharp objects; therefore, parents need to be educated about the excessive noise levels that these toys produce and the associated danger.

Objectives

The primary objective of this paper was to critically evaluate existing literature regarding use of preschool aged toys resulting in NIHL in children due to the intensity of the noise emitted. The secondary objective was to propose evidence-based

recommendations for changes in the current toy safety regulations.

Methods

Search Strategy

Computerized databases, including CINAHL, PubMed, MedLine, and Cochrane, were searched using the following search strategy:

(Children) AND (Noise Induced hearing loss) AND (Noisy Toys)

Limits applied to the search were:

English and Preschool aged children.

Selection Criteria

Studies selected for inclusion in this critical review were required to investigate the current noise levels preschool aged toys are emitting or the distance at which children are playing with the toys. There is no research directly studying whether or not preschool aged toys are resulting in NIHL in children due to given ethical considerations because a prospective RCT or controlled study can not be completed on human children.

Data Collection

Results of the literature search yielded the following types of articles congruent with the aforementioned selection criteria: descriptive research designs (4).

Results

Descriptive Designs

Two studies were undertaken to determine the current risk of NIHL from toys currently on the market (Yaremchuk, Dickson, Burk, & Shivapuja, 1997; Larocque, 2004).

Yaremchuk, et. al, (1997) purchased 25 preschool age-appropriate toys at a national toy chain and sound levels were measured at distances approximating ear level (2.5cm) and a child's arm length (25cm) from the surface of the toy. Tests revealed peak sound levels ranging from 81 to 126 dB(A) at 2.5 cm and 80 to 115dB(A) at 25 cm from the surface of the toy. Yaremchuk et. al (1997) used The National Bureau of Standards (NBS) to assess the output level on a convenience sample of toys that subjectively emitted loud sounds.

Yaremchuk, et. al. (1997) also addressed the issue that infants and children younger than 2 years of age have resonant frequencies in the 6-8kHz range and therefore, the sound pressure levels of toys are expected to be more intense at those resonant frequencies in these younger children. Therefore, the high sound intensities seen in the measurements may be more damaging to infants and younger children when toys are played with at 'ear level'. The current guidelines of only testing toys at 25cm to determine noise levels is inadequate since children routinely play with toys without the supervision of adults and at closer distances than 25cm.

Larocque (2004) measured 40 sound-producing toys currently on the market selected by Option Consommateurs. The selection criteria were not given in the study therefore, it can not be assumed that the selection process was random or that they toys selected were a typical representation of children's toys. The Health Canada's methodology, "Test Method to Determine the Noise Level of Toys" was used in this study (Health Canada, 1996). This methodology stipulated that measurements must be made with a type I sound level meter, that five-5 second measurements must be taken for each noise emitted, and that readings must be taken in fast response time to measure the maximum RMS (root mean square) level in dBA. The toys were measured under conditions that appear to reflect the way in which children 0-3 years of age play with the toys, which resulted in almost all the toys exceeding the World Health Organization guidelines. The majority of the toys tested were likely to cause NIHL over time, even with very short play periods (less than 10 minutes per day).

Overall, these studies reflect good acoustical measurement practice because they have used standard measurement techniques. Yarmechuk, et. al used the NBS while Larocque used Health Canada's methodology, "Test Method to Determine the Noise Level of Toys". Both studies used convenience samples of toys, therefore, the results may not be generalizable to all toys on the market. The studies also did not give any statistical analysis of the results to determine whether the output levels of the toys differed significantly.

Survey/Questionnaire

Charbonneau and Goldschmidt (2004) and Brookhouser, Worthington, and Kelly (1992) used questionnaires and surveys in a retrospective fashion to collect information about noisy toy use, rather than measure the output of or exposure from noisy toys.

Charbonneau and Goldschmidt (2004) assessed whether consumers are well-informed about the noise generated by sound-producing toys and also assessed the distances at which preschool age children are playing with their toys. Field tests showed that the majority of the toys (53%) designed for the 0-3 year old age group were in fact being held much closer to the ear than the distance specified in the current law's measurement protocol.

The families selected to participate in the survey were not randomly selected and the survey was not piloted before the study was conducted therefore, the psychometric properties of the questionnaire are unknown. The questionnaire filled out by parents consisted of both open-ended and close-ended questions. The reliability and validity of the study is questionable because instructions were not given to the parents, thereby possibly creating inconsistent responses. Nor was it indicated whether a cover letter was provided. The study did not discuss scoring or analyzing the information, making the interpretation of the results difficult. Some of the open-ended questions could elicit a wide range of responses, making summary statements difficult to report. The close-ended questions exhausted the possible responses, and were therefore, suitable for inclusion in the questionnaire. All of the questions used simple language and no double-barreled questions were included.

Brookhouser, et. al (1992) addressed the issue of NIHL in preschool and school-aged children to identify the noise sources most often incriminated and to explore educational strategies aimed at prevention. The study was efficient at identifying an

association between an existing hearing loss and prior exposure. However, because of the retrospective approach the determination of a causal relationship could not be made.

One hundred and fourteen of 2284 consecutive patients, aged 19.9 years and younger, diagnosed as having sensorineural hearing impairment at the Boys Town National Research Hospital were classified as having probable NIHL. The population of children from which the sample was drawn is typical of those referred to a large pediatric otolaryngology/audiology clinic and do not represent a random sample of the general pediatric population. Although the population is not generalizable, drawing from a convenience population may be the first step before the researchers are able to obtain funding to open the study to the general population.

A case history was completed to exclude those from the study who had familial hearing loss, prenatal infections, stressful delivery or NICU admission, mumps, head trauma requiring medical evaluation with or without loss of consciousness, meningitis, recurrent otitis media, or treatment with ototoxic drugs. Even though some of the excluded children had histories of noise exposure they were not included in the study because of the aforementioned potential confounding variables.

The questionnaire used was not standardized or piloted, which decreased reliability and validity. The way in which the case history was obtained is unknown, and no statistical analysis was mentioned. Given the lack of generalizability, the study provides some evidence of association between hearing loss and noise exposure in youth, in a limited capacity.

Recommendations for Clinical Practice

The aforementioned research indicates that noise levels emitted from currently available toys are intense enough to cause damage to the auditory system in children. However, NIHL is a combination of both intensity of noise and the duration of exposure. Therefore, knowing only the intensity of the toys is insufficient as a predictor of the hearing hazard. Without knowledge of exposure and typical use durations, it would be advisable for clinicians to warn parents against the potential danger in preschool aged-appropriate toys. However, it must be stated that the existing research is methodologically limited and therefore, a concrete statement regarding specific effects and guidelines for current toys should not be made at this time. Further research possibilities are limited due to ethical restrictions and the limited

sensitivity of audiometric testing. Current clinical tests are unable to reveal the beginning stages of inner hair cell damage and therefore, a direct correlation between use of preschool age-appropriate toys and NIHL is difficult to establish.

References

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