PREVENTION OF NOISE-INDUCED HEARING LOSS IN ADOLESCENTS

Brian J. McKinnon, MD, MBA, MPH, FACS
Department of Otolaryngology – Head & Neck Surgery,
Drexel University College of Medicine, Philadelphia, PA, USA

ABSTRACT

Adolescent noise-induced hearing loss has been a concern for many years. Hearing conservation programs directed at adolescents employed in agriculture have achieved short- and long- term improvements in the use of hearing protection devices (HPD). Recently, concerns regarding the noise-induced hearing loss in adolescents have been heightened by a perceived risk from recreational activities, particularly those associated with music. To assess the effectiveness of hearing conservation programs at preventing recreational noise-induced hearing loss, a literature review with data analysis was performed. Three studies were identified as being appropriate, and the data on effectiveness at increasing the use of HPDs, and improving intent to change risk behaviors extracted. Data analyses found that the intent to change risk behavior was not statistically different between post-intervention and baseline, though the use of HPD achieved a statistically significant improvement afterwards. The increase in HPD use was minor, and the overall use was not significant enough to meaningfully reduce recreational noise-induced hearing loss in adolescents. Future efforts should focus on developing hearing conservation programs that can more effectively improve HPD use and change risk behavior.

CONTACT

Brian J. McKinnon, MD, MBA, MPH, FACS
Vice Chair & Associate Professor
Department of Otolaryngology – Head & Neck Surgery
Drexel University College of Medicine
219 N Broad Street, 10th Floor
Philadelphia, PA, 19107
Phone: 516-244-1008
Email: bmckinnon@phillyent.com

Introduction

- Hearing impairment impacts 1.3 billion
- In US a leading cause of Years Lost to Disability
  - 560,000 in 2010
- Prevalence in US adolescents is 19.3%
  - 1° high frequency involvement due to noise exposure
  - Environmental, recreational, occupational
  - Noise-induced hearing loss is preventable
  - Significant risk factor is personal listening device use
- Noise-induced hearing loss prevention primarily focused on adults
- Work related noise-induced hearing loss prevention literature limited & low quality
- Adult noise-induced hearing loss prevention is focused on occupational exposure
  - Adolescent exposure is primarily recreational
- Occupational noise exposure in adults is declining
  - Non-occupational/recreational noise exposure increasing
- Modifiable risk factors in child and adolescent hearing loss
  - Tobacco exposure
  - Noise exposure
- 40% never wear hearing protection in noisy educational/work environs
  - when worn, hearing protection of limited effectiveness
- Personal listening devices appear to be biggest challenge
  - 250 million sold worldwide
  - Volume up to 115+ dB
- Multiple school based education program
  - Many focused on elementary school age children
  - more effective in children than adolescents
- Programs are school based, do not incorporate parents
- Programs have not been widely adopted
  - Class room based more effective that web based
- Self reported personal listening device volume decrease
  - "80-90" rule - Listening at 80% volume for 90 minutes a day is about 50% noise dose
- Very limited hearing protection use following training

Hearing Conservation Education Recommended Topics

- Normal auditory mechanisms
- Types of hearing loss and causes
- Noise and effect on hearing
- Warning signs of noise-induced hearing loss
  - Effect on quality of life
  - What kind of noise is most harmful
- Prevention
  - Turn down volume
  - Move away
  - Hearing protection devices

Purpose

- Meta-analysis assessing effectiveness
  - Changing Behavior
    - Personal listening device use
    - Hearing protection use
- Identify the more effective strategies
- Encourage adoption of effective strategies
- Encourage school support for hearing conservation programs

METHODS

- Preliminary literature search
  - Key words "hearing loss", "noise-induced", "adolescent"
  - 567 English language articles
  - Abstract review identified 51 articles related to hearing conservation, hearing loss prevention, use of hearing protection, use of personal listening devices, perceived risk of noise induced hearing loss
- Preliminary literature search findings
  - Many hearing conservation programs
    - Adequate , often excellent
    - Not being taught in schools
    - Lack of public concerns, champions
  - Much early work focused on adolescent farm workers
    - Hearing protection use of 87.5%
    - 16 year follow up 25.9%-56.2% depending on activity
  - Recreational/Personal listening device programs
    - Dangerous Decibels
    - Cheers for Ears
    - Sound Sense
    - Iets Minder is de Max
  - Many focused on those less than 10 years of age
    - All reported improvements in knowledge
    - Limited data on changing hearing protection/personal listening device use
- Secondary literature search
  - Key words "hearing loss", "noise-induced",
  - Filters: last 10 years, English, ages 10-19
  - 215 English language articles
  - Abstract review identified 16 articles
  - Full text review identified 3 articles
- Extracted data entered into Excel
  - Two tailed Z test, α=0.05 (-1.96 to 1.96)

Statistics

- Independent samples
- Difference in proportions
- Z score - distance and direction from the mean
- Approximate test was used
- Null Hypothesis
  - No difference between groups

Results

- Griest (2007) Dangerous Decibels
  - 4th and 7th graders, US, school based
  - Assessed baseline, immediate post, and 3 months
  - Intent to use HPD increased, HPD use unchanged at 3 months
- Neufeld (2010) Sound Sense
  - 6th graders, Canada school based
  - assessed, baseline, 2 wk and 6 months
  - Sustained improvement in hearing protection use, but still low
- Gilles (2014) Iets Minder is de Max
  - 14-18 year old Belgian Students, school based
    - Promoted via traditional media, social media, websites
    - Youth Attitudes to Noise, modified Beliefs about Hearing Protection and Hearing Loss surveys used to assess impact
  - Assessed baseline, 8 months
  - Intent to use hearing protection and reported increase in use at 8 months
  - No change in personal listening device use was found

For References please contact author

RESULTS (CONTINUED)

- Youth Attitudes to Noiase consisted of 19 items evaluating attitudes toward
  - youth culture associated noise
  - noisy environments and concentration/attention
  - every-day noise
  - influencing the sound environment
- Beliefs about Hearing Protection and Hearing Loss was modified to 7 categories (the standard has 8)
  - susceptibility to hearing loss
  - impact of hearing loss
  - benefits of hearing loss prevention
  - barriers to hearing loss prevention
  - intended behavior
  - social norms
  - self-efficacy.
- Assesses the norms and perceived control
- Assess changes in intention and use of hearing protection

Statistical Results

	Pre HP use	Post HP use	Time
Neufeld(2010)	2.40%	4.30%	6 months
Gilles(2104)	3.60%	14.30%	8 months
Mean	3.00%	9.30%	7 months

	Pre Intent	Post Intent	Time
Griest(2007)	15.20%	16.20%	3 months
Gilles(2104)	8.30%	39.30%	8 months
Mean	11.75%	27.75%	5.5 months

Use of hearing protection (HP) was statistically different (p=0.0016), intent to change behavior (Intent) was not (p=0.0525), using a 2 tailed Z test.

CONCLUSIONS

- Adolescent noise-induced hearing loss is a significant concern
- Limited literature to guide public policy
- Education programs improve knowledge
  - Minimal impact on behavior
  - No uniform reporting of results
- Lack of parental involvement a weakness
- Mirrors findings of adult occupational hearing conservation programs
- Significant opportunities to re-evaluate and re-design
  - Incorporation of social media, text reminders

Recommendations

- Adopt what works
  - free hearing protection, annual hearing screening, reminders
- Adopt consistent reporting instruments
  - Youth Attitudes to Noise, Beliefs about Hearing Protection and Hearing Loss
- Identify objective reporting methods
  - Hearing protection, personal listening device use
- Identify what is clinically significant hearing protection, personal listening device use
  - "80-90" rule
  - 16% "at risk" population
- Engage parents, public authorities, manufactures