

# Evaluating Personal Attenuation Ratings of Midwest Agricultural and Industrial Workers

Christie De Vito, GSP, Jenna Gibbs, PhD, and T. Renée Anthony, PhD

Department of Occupational and Environmental Health, College of Public Health, University of Iowa

## Background

Hearing protection standards have progressed since 1970. However, the prevalence of hearing loss has not decreased.

Industrial workers enrolled in hearing conservation programs receive annual training on hearing protection.

Agricultural workers often only receive training during outreach events or if they also work in industry.

This study measured personal attenuation ratings (PAR) for four hearing protection devices (3M) to understand if agricultural and industrial workers can achieve the manufacturer's noise reduction ratings (NRR) for hearing protection devices (HPD).

## Objectives

1. How do the personal attenuation ratings compare to the manufacturer noise reduction rating?
2. Does one HPD provide better protection compared to the others?
3. Does one occupational group perform better than the other?
4. Are there differences in personal attenuation by age or gender?

## Method

Agricultural Participants:

- Recruited from four farm shows/county fairs
- Lived or worked on a farm at any time
- Over 16 years old

Industrial Participants:

- Recruited from three local manufacturing sites
- Enrolled in site hearing conservation program

HPD tested

3M Earplug	NRR (dB)		
Ultrafit™	26		Non-formable
Push-Ins™	28		
Classic™	31		Formable
Yellow Neon	33		

## Method, continued

Used 3M EARfit Dual Validation System (393-1100)

- Daily microphone calibration
- Daily self-test to confirm PAR (Yellow Neon)

Tested Participants

- Participant selected and inserted *preferred* HPD
- Measured PAR

If *low*: retrained, retested on same HPD

- Measured PAR for *each remaining* HPD

Computed mean PAR

- For preferred tested earplug
- By earplug and participant age

Evaluated data

- Significant difference in PAR by occupation, gender, age, and HPD (Kruskal-Wallis, Odds Ratio)

## Results

- 60 Agricultural, 76 Industrial (136 workers total; 536 tests)
- Mean Age: 46 years (SD: 17 years)
- 55% Males; 45% Females
- On average, PAR 10.2 dBA (SD: 9.1 dBA) below NRR

Mean PAR by Age Group and Occupation

Age Group	Agriculture			Industry			PAR Comparison, Kruskal-Wallis, p
	Total Number of Tests	Mean PAR	SD PAR	Total Number of Tests	Mean PAR	SD PAR	
16-20	66	14.6	8.2	6	16.3	9.9	0.45
21-50	59	11.9	8.9	110	12.6	8.5	0.53
51-64	68	13.8	8.7	131	8.9	8.2	0.91
65-80	54	7.8	8.1	28	6.3	6.9	0.95
All	247			275			

Boxes identifies significantly different PARs, Kruskal-Wallis,  $p < 0.04$ .

Occupation:

- Agricultural workers insignificantly larger mean PAR of 1.1 dBA

Gender:

- Women only obtained significantly higher PAR for Classic HPD ( $p = 0.04$ )

Age:

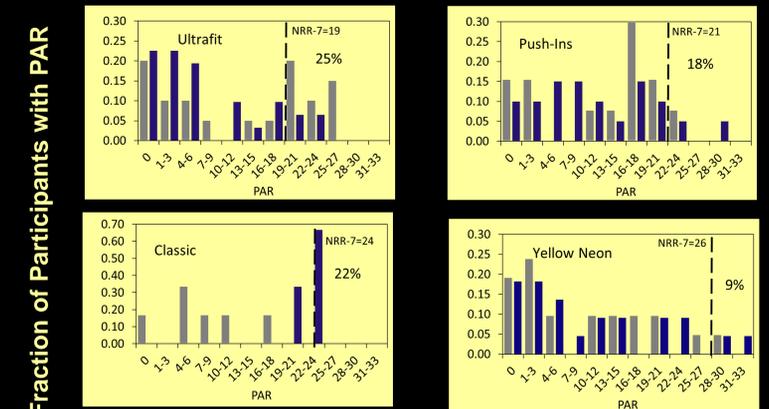
- The chance of attaining PAR > (NRR-7) for workers 51-64 years old was only 22% of that for younger workers (16-20 years old)

HPD Type:

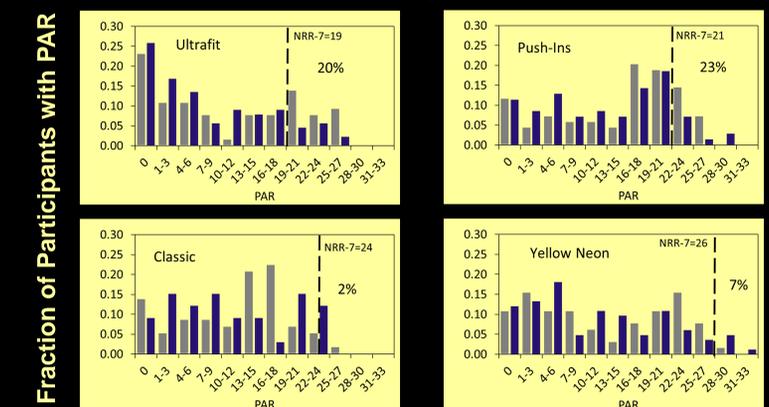
- Push-Ins had the highest percentage > (NRR-7) and highest mean PAR

## Results, continued

Personal Attenuation Rating (PAR) for Preferred HPD Tests



Personal Attenuation Rating (PAR) for All HPD Tests



Personal Attenuation Rating (dBA) Measured for Each Participant

The % indicates the fraction of participants who achieved  $\geq$  the A-weighted adjusted manufacturer reported (NRR-7).

## Conclusions

Cannot rely on NRR alone to ensure effectiveness  
<25% achieved "good" fit (NRR-7)

Need for customized training and use of PAR assessment devices to ensure workers obtaining protective fit

Monitoring of fit of HPD over worker lifetime needed to prevent NIHL as workers age

## Future Steps

Test different sized HPD (large/small) is needed, particularly for older workers

Conduct follow-up testing and interviews

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