

Dining with Decibels: Noise Exposures of College Town Restaurant Employees

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Background

22 million people/yr in the United States are exposed to hazardous noise, with 10 million diagnosed with noise induced hearing loss (NIHL).

In 2012, 9.4 million workers were classified in food preparation and serving related occupations (SOC 35).

Eight-hour exposure limits

- OSHA: 90 dBA (regulatory limit)
- NIOSH: 85 dBA (health-protective recommendation)

Prolonged exposure at or above 85 dBA has the potential to result in permanent hearing loss.

Few studies have used personal monitoring to characterize restaurant worker noise exposures

- Restaurants in Hong Kong: employee exposures > 90 dBA
- Nightclubs in Ireland: employee exposures 89 to 97 dBA

With noise levels approaching or exceeding 85 dBA, restaurant workers are potentially at risk for NIHL.

Objectives

1. Assess occupational noise exposure of restaurant workers in locally owned college town restaurants (day shift).
2. Determine whether season, restaurant type, job title, and day of week are factors associated with noise exposure differences among restaurant employees.

Methods

Enrolled six locally owned downtown restaurants

- Day shift (10 am – 7 pm) only

Monitoring plan was designed to obtain three replicate exposure assessments per:

- Season: *Summer, Fall* (University in session)
- Day of week: *Weekday* (M-Th), *Weekend* (F, Sat)

Exposure assessment examined workers:

- At *Limited Service* or *Full Service* restaurants only
- As many as five workers per business, per visit, with job titles: *Servers, Cooks, and/or Cashiers*

Personal dosimeters were used:

- Quest Noise-Pro & Edge 5
- Two settings
 - OSHA Hearing Conservation
 - NIOSH w/ 70 dBA threshold
- Logged continuously over each worker's shift

Two-sample t-tests and multiple linear regression were used to assess whether exposures were greater for each of the four factors, separately and combined.

Results

Objective 1

Obtained 180 full shift exposures (Fig. 1)

- No TWA exceeded 90 dBA OSHA PEL
- *Fourteen* TWAs exceeded 85 dBA NIOSH REL
- *Five* samples exceed the OSHA action limit of 85 dBA
- Mean values, by study factor, computed (Table 1)

Of one-minute noise data:

- 0.7% (323 minutes) > 90 dBA
- 8.5% (3968 minutes) > 85 dBA

Further analysis used TWA from NIOSH sampling criterion

- TWAs ranged from 69 to 90 dBA
- Mean = 80 dBA (S.D. 4 dBA)

Since 7.8% of all full-shift exposure data exceeded the NIOSH 8-hour 85 dBA, an estimated 733,000 US workers may be at risk.

Figure 1: Example time-series of 1-minute average sound levels (L_{avg}) for a cook in a *limited-service* restaurant

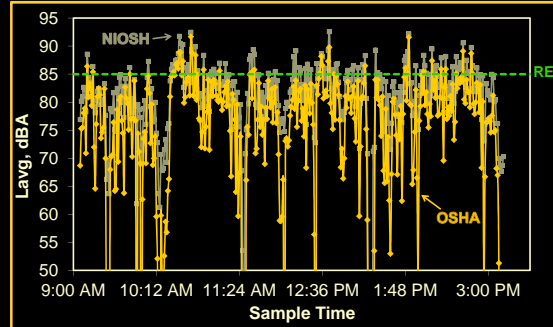


Table 1: Mean (S.D.) projected TWA in dBA of personal exposures using OSHA and NIOSH sampling criteria

OSHA	
Summer 66.3 (5.1)	Not Summer 72.9 (7.0)
Full-Service 73.2 (5.8)	Limited Service 69.9 (6.1)
Cook 73.6 (5.2)	Not Cook 70.6 (6.3)
Weekday 70.6 (5.4)	Weekend 73.1 (6.9)
NIOSH	
Summer 79.0 (3.0)	Not Summer 80.7 (4.3)
Full-Service 80.5 (3.5)	Limited Service 78.6 (3.8)
Cook 80.8 (3.3)	Not Cook 79.1 (3.8)
Weekday 79.2 (3.3)	Weekend 80.4 (4.2)

Note: Green text indicates the higher exposure group across rows.

Results, continued

Objective 2

Significant difference in restaurant worker exposures by restaurant type, job title, season and day of week, confirmed by:

- Two sample t-tests (Table 2)
- Multiple linear regression (box below)

Table 2: Assessment of significant noise exposure differences, by individual factor, using two sample t-tests.

Factor	Level	n	P*
Season	Summer	99	0.003
	Not Summer	81	
Job Title	Cook	66	0.003
	Not Cook	114	
Day of Week	Weekday	103	0.048
	Weekend	77	
Restaurant Type	Full-Service	107	<0.001
	Limited-Service	73	

*Using F-test, season and day of week had unequal variance while job title and restaurant type had equal variance.

Multiple Linear Regression:

$$TWA = 76.2 + 2.35 (\text{Restaurant Type}) + 1.96 (\text{Job Title}) + 1.84 (\text{Season}) + 1.35 (\text{Day of Week}) \dots (R^2 = 0.22)$$

Reference value (0) assigned to limited-service, not cook, summer, and weekday.

Conclusions

During day shifts, 7.8% of restaurant workers were identified as at-risk of noise induced hearing loss using the NIOSH criteria.

Noise exposures in this college town were statistically significantly louder:

- When the University was in session,
- For workers in full-service restaurants,
- On the weekends, and
- With workers classified as cooks.

Intervention studies for the prevention of noise induced hearing loss in restaurant workers need to understand the impact these factors on restaurant worker noise exposure.

Additional assessments of exposures during the night-shift is needed to fully characterize restaurant worker exposures.

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