Secondhand Smoke Exposure Assessment Among Casino Dealers

Results from a NIOSH Health Hazard Evaluation

Tobacco Control Network Webinar
Smokefree Laws & Gaming
Everything You Wanted to Know But Were Afraid to Ask

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CDC Workplace Safety and Health

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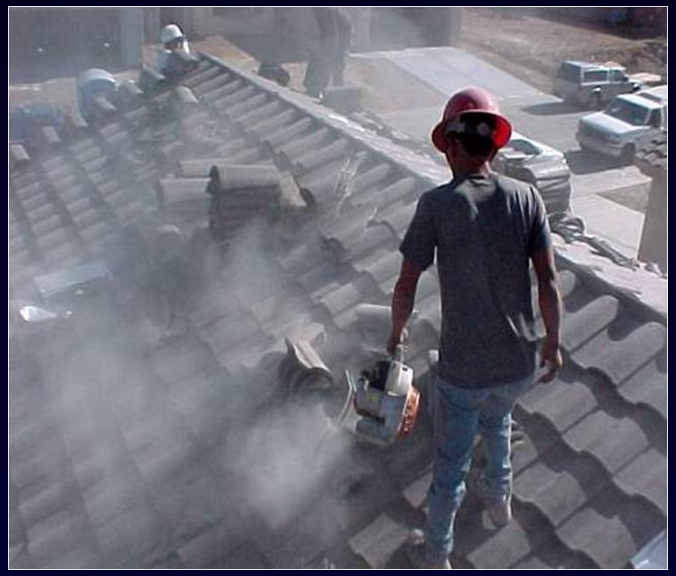
NIOSH

Outline of Presentation

- Describe the background and objectives of the NIOSH SHS* evaluation in three Las Vegas casinos
- Summarize the assessment methods used to evaluate SHS exposure and health symptoms in casino dealers
- Identify the key findings, conclusions, and recommendations from the evaluation

*SHS: Secondhand Smoke

What is NIOSH?



- National Institute for Occupational Safety and Health
  - Part of the CDC
  - Charged with Occupational Safety and Health
    - Research
    - Surveillance
    - Training
    - Conduct Health Hazard Evaluations (HHE)
  - Different from OSHA

Health Hazard Evaluation Methods

- Observe work practices
- Interview employees
- Review records
- Administer questionnaires
- Environmental Sampling
  - Air Sampling for chemical exposures
- Biological Sampling
  - Collect blood and urine for biological markers of exposure, “biomarkers”

Other Casino SHS Studies

- Atlantic City casino worker HHE [Trout et al.1994]
  - Biomarker levels increased during workshift and were higher than levels of nonsmokers in national survey
- Casino patron study [Anderson et al. 2003]
  - Demonstrated increase in carcinogen biomarker over a 4-hour time period
- London casino worker study [Pilkington et al. 2007]
  - Higher prevalence of health symptoms in casino workers compared to bar workers
- Pennsylvania casino study [Repace 2009]
  - Demonstrated casino workers have higher risk of death than Pennsylvania miners based on levels of SHS air contaminants measured in casinos

Background of Health Hazard Evaluation

- Confidential employee HHE request in 2005
  - Casino dealers from 3 Las Vegas casinos
  - Symptoms: respiratory, eye irritation, headache
- Smoking permitted in all gaming areas except poker room in one casino
- 1,188 casino dealers employed in 3 casinos

Assessment

- Interviewed casino workers

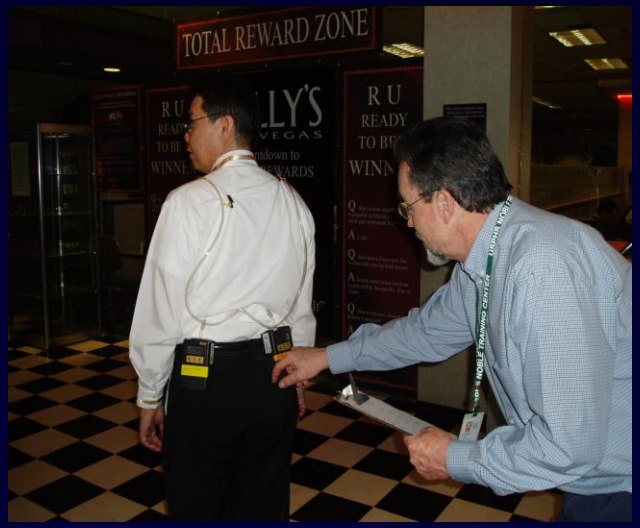
- Reviewed OSHA injury and illness logs
- Quantified casino dealers' SHS exposure
  - Conducted air sampling of SHS components
  - Measured SHS biomarkers in casino dealer's urine
- Determined the prevalence of respiratory symptoms among casino dealers
  - Administered a health symptom questionnaire to casino dealers and unexposed casino workers

Participants

- Exposed casino workers
  - Casino dealers (non-poker)
  - Nonsmoker and not living with smoker
  - Work exposure only
  - For air and urine testing:
    - Working night/swing shift Thursday, Friday, Saturday and day shift Sunday
- Unexposed casino employees for health symptom questionnaire
  - Administrators and engineers

Methods: Air Sampling

- Full-shift area and personal breathing zone (pbz) sampling
- 120 casino dealers from 3 casinos
- Thursday – Sunday on swing and day shift
- Monitored for:
  - Nicotine
  - 4-Vinyl Pyridine
  - Polynuclear aromatic hydrocarbons
  - Volatile organic compounds
  - Total Hydrocarbons
  - Respirable suspended particulates
  - Carbon monoxide
  - Aldehydes



Methods: Biological Monitoring

- Pre-shift and post-shift urine samples
- 124 casino dealers from 3 casinos
  - 90% participated in air testing
- Analyzed for 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL) and cotinine
  - NNAL
    - Metabolite of 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), nitrosamine
    - Specific to tobacco
    - Lung carcinogen
  - Cotinine
    - Metabolite of nicotine
    - Commonly used as an indicator of SHS exposure*

Methods: Health Symptom Questionnaire

- Mailed to 323 eligible dealers (exposed) and 42 administrators and engineers (unexposed)
- Symptoms:
  - Eye redness or irritation
  - Nasal congestion
  - Throat irritation, cough
  - Shortness of breath, chest tightness
  - Nausea, headaches
  - Asthma symptoms
- Established if work-related

Statistical Analysis

- Chi-Square and Fisher's Exact tests
  - Differences in symptom prevalences
- Paired t tests and paired sign tests
  - Differences in preshift and postshift urinary NNAL and cotinine
- Pearson's and Spearman's correlation coefficients
  - Comparison of environmental and biological sampling results

Results: Air Sampling

- Identified the following SHS components in air:
  - Nicotine
  - 4-vinyl pyridine
  - Respirable suspended particulates
    - Solanesol
  - Polynuclear Aromatic Hydrocarbons
    - Naphthalene
  - Aldehydes
    - Formaldehyde
    - Acetaldehyde
  - Volatile Organic Compounds
    - Toluene
    - Benzene

Results: Biological Monitoring

- Levels of NNAL, adjusted and unadjusted for creatinine, increased significantly during an 8-hour workshift
- Levels of cotinine, adjusted for creatinine, did not increase significantly during an 8-hour workshift
- Levels of cotinine, unadjusted for creatinine, increased significantly during an 8-hour workshift
- No statistically significant positive correlation was found between urine and air measures

Results: Health Symptom Questionnaire

- 53% participation rate
  - 147 exposed and 12 unexposed
- Mean age of exposed and unexposed: 48 years
- Most common health symptoms reported by exposed casino dealers:
  - Red or irritated eyes (49%)
  - Cough (48%)
  - Stuffy nose (43%)
- Twenty-four percent of exposed casino dealers reported symptoms suggestive of work-related asthma
- Higher symptom prevalences reported by exposed, not statistically significant

Air Sampling Findings

- Area air concentrations similar to the PBZ sample concentrations
- Range of area air sample concentrations of nicotine was comparable to past data measured in casinos where smoking is permitted
- Multiple chemical exposures from SHS
  - Health effects from combined effects

Biological Monitoring Findings

- Increase in NNAL during work shift demonstrates work exposure
- Exposed to lung carcinogen
- NNAL specific to tobacco smoke
- Symptom prevalences similar to other studies in SHS exposed populations

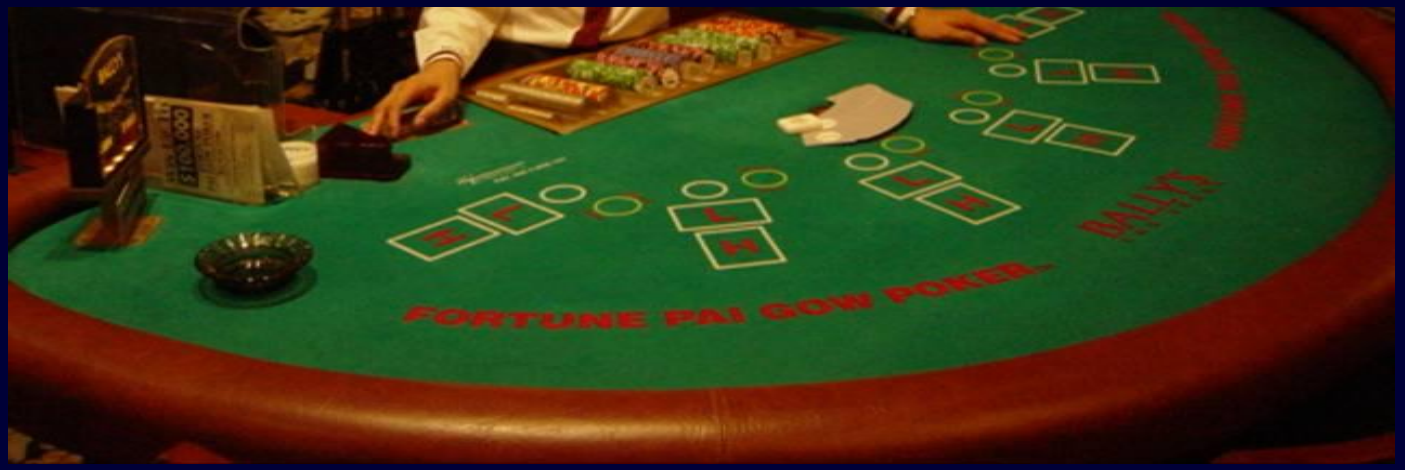
Limitations

- Actual symptom prevalences may be different from reported prevalences
  - Self-reported symptoms
  - Convenience sample
  - Low participation for health symptom questionnaire
- Unable to provide conclusions about cotinine results

Conclusions

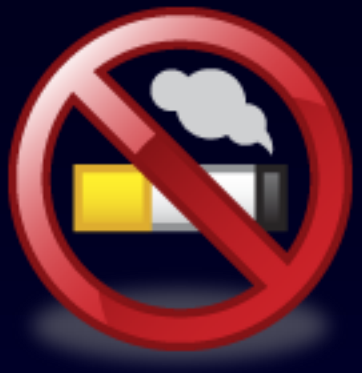
- Casino dealers exposed to SHS in the workplace
  - Exposed to several SHS air components
  - Measurable increase of a known lung carcinogen over a work shift

- Casino dealers reported work-related health symptoms



Recommendations

- Institute casino-wide no smoking policies
  - 2006 U.S. Surgeon General's report states that there is no risk-free level of ETS exposure



- Eliminate smoking near building entrances and air intakes
- Recommend employees with respiratory symptoms seek care from a physician
- Develop a smoking cessation program for casino employees who smoke

Response to HHE Report

- HHE report released May 5, 2009
- Great interest among national tobacco control organizations and advocacy groups
- NIOSH Science Blog on smoking and casino dealers
- Findings disseminated at conferences, publications
- Influence over current legislation
  - Nevada Bill 372 and New Jersey Bill A-806
- Extensive press coverage
  - Over 40 news articles
  - Live NPR interview

Acknowledgements

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The findings and conclusions are those of the author and do not necessarily represent the views of the National Institute for Occupational Safety and Health

More Information

- Contact Information:

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- Health Hazard Evaluation Program:

  www.cdc.gov/niosh/hhe
- Link to Health Hazard Evaluation Report on SHS in Casinos:

  www.cdc.gov/niosh/hhe/reports/pdfs/2005-0201-3080.pdf
- NIOSH Science Blog:

  www.cdc.gov/niosh/blog/nsb061609_casino.html

Results: Air Testing

Analyte	PBZ GM (n) ug/m^3	Area GM (n) ug/m^3
Acetaldehyde	10.2 (29)	11.0 (19)
Nicotine	5.32 (107)	1.20 (24)
4-Vinyl Pyridine	1.00 (107)	8.91 (19)
Formaldehyde	8.96 (29)	6.69 (24)
Polynuclear Aromatic Hydrocarbons	0.790 (34)	0.729 (23)
Respirable Suspended Particulates	42.1 (33)	41.4 (22)
Solanasol	0.226 (33)	0.242 (22)
Total hydrocarbons	438 (22)	354 (24)
Toluene	13.9 (22)	10.6 (24)
Carbon Monoxide	Range 0.8–5.3 ppm	

Results: Urine Testing

	Cotinine Pre-shift GM (n)	Cotinine Post-shift GM (n) Ng/ml	NNAL Pre-shift GM (n)	NNAL Post-shift GM (n)
Creatinine Unadjusted Ng/mL	22.25 (114)	30.37 (114)	0.0039 (114)	0.0069 (114)
Creatinine adjusted	0.1655 (112) nmol/mgcr	0.1536 (112) Nmol/mgcr	0.0242 (113) Pmol/mgcr	0.0290 (113) Pmol/mgcr

NNAL: 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanol