Secondhand smoke, lung disease, & public health

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Overview
- Secondhand smoke (SHS) exposure – scope of the problem
- How much asthma / COPD is attributable to SHS?
- Can SHS exacerbate asthma / COPD?
- SHS exposure, lung function, and cardiovascular mortality
- The workplace – a nidus for change
- Coda: time to clear the air

Generation of SHS

Mainstream
- SHS contains >4,000 chemical constituents
- 4 of U.S. EPA criteria air pollutants emitted in SHS - PM$_{10}$, NO$_2$, SO$_2$, CO

Sidestream

Tobacco smoke exposure – what’s in a name?
Chapman S, Tobacco Control 2003
- Passive smoke / smoking
  - First term for “other people’s smoke”
  - Disliked by Helmut Wakeham at PM
- Environmental tobacco smoke
  - Coined by Ragnar Rylander, tobacco industry consultant
  - “More precise definition” than passive smoking
  - First use: proceedings of an industry sponsored meeting in 1974
- Secondhand smoke
  - Neutral
  - Most commonly used term in the media
  - Now considered the preferred term

SHS exposure
Scope of the problem (Eisner MD. Environmental Health Persp 2002)


<table>
<thead>
<tr>
<th></th>
<th>Adults with asthma</th>
<th>Adults without asthma</th>
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<tbody>
<tr>
<td>Detectable cotinine (%)</td>
<td>86% (81 to 91%)</td>
<td>83% (81 to 86%)</td>
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P = 0.38 for comparison

How much OLD is due to SHS?
- SHS has potent respiratory irritants - acrolein, formaldehyde
- Irritant and / or sensitizing mechanism
**SHS is a cause of childhood asthma**

Cohort studies
Strachan and Cook, Thorax 1998

Case-control studies
OEHHA meta-analysis
85 studies
460,000 children
29 countries
Pooled OR 1.32 (1.24-1.41)*

*in 29 studies that controlled for childhood atopy and smoking

**Lifetime SHS exposure and incident asthma**
Jaakkola, AJPH 2003

**Recent SHS exposure and chronic bronchitis (SAPALDIA Study)**

- 4,197 never smoking adults (18-60 yrs)
- Any self-reported SHS exposure during the past 12 months vs. none
- Cross-sectional analysis
  - Chronic bronchitis OR 1.65 (1.26-2.14)
  - Dyspnea on exertion OR 1.43 (1.18-1.74)

*controlling for educational level
Leuenberger et al, AJRCCM 1994

**Longitudinal impact of SHS on CB**

SAPALDIA cohort study (1421 never smokers)
Javet et al. Scand J Work Environ Health 2005

**Lifetime SHS and chronic bronchitis**
Robbins et al (Int J Epidemiol 1993)

**Lifetime SHS exposure and the risk of COPD**
Eisner et al. Environmental Research 2005

- Population-based sample of 2,113 adults aged 55-75 years residing in contiguous 48 U.S. states
- Structured telephone interviews
- Cumulative lifetime home and work exposure ascertained
- COPD = self-reported physician diagnosis of chronic bronchitis, emphysema, or COPD
SHS and COPD - analysis

Prenatal SHS exposure
Cumulative lifetime home SHS exposure
Cumulative lifetime work SHS exposure
Risk of COPD

Potential confounders - age, sex, race, smoking, education, marital status, workplace VGDF

Lifetime SHS exposure and the risk of COPD
Eisner et al. Environmental Research 2005

0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6

Prenatal Home Work

0.2 0.4 0.6 0.8 1 1.2 1.4 1.6

Q1 Q3 Q4 Q1 Q3 Q4

Risk of COPD

Prenatal Home Work

How much OLD is “attributable” to SHS exposure?

ADULT ASTHMA
- Total SHS exposure – 1/12 cases

COPD
- Home SHS exposure – 1/11 cases
- Workplace SHS exposure – 1/15 cases

CHILDHOOD ASTHMA
- 1/10 cases (>200,000 children 0-17 yrs in USA)

Can SHS exposure exacerbate asthma?
Eisner et al, Environ Health Persp, 2001
n=50 adults with asthma

Personal Badge
Monitor Nicotine Level

Eye or nose irritation
Cough, wheeze, or chest tightness
Extra bronchodilator use

7 day monitoring period Telephone survey

SHS exposure and longitudinal health outcomes

349 adults with asthma - 18 month follow-up

SHS exposure measurement
ED Visits (OR, 95% CI) Hospitalization (OR, 95% CI)
Baseline, past 7 d
None 1.0 1.0
Any 2.8 (1.2 to 6.4) 6.6 (1.3 to 33)
Baseline, past 7 d
None 1.0 1.0
Lower (1-2 hr/wk) 2.5 (0.93 to 6.6) 4.6 (0.7 to 40)
Higher (3+ hr/wk) 3.4 (1.1 to 10.3) 12.2 (1.5 to 102)

*controlling for age, gender, education, income
SHS exposure and risk of hospitalization for asthma
Eisner et al, Thorax 2005
Cohort of 138 adults hospitalized for asthma age 65+ yrs.
Exposure = hair nicotine, past 1 month

Proportion free of re-hospitalization

Time until re-hospitalization (days)

Cox proportional hazards analysis controlling for age, sex, race, educational attainment, marital status, and previous smoking history

SHS exposure and re-hospitalization asthma (2)

Hair nicotine, past 1 month

SHS exposure and pulmonary function in female NHANES III participants
Eisner MD. Environ Health Persp 2002

FEV1 (ml/sec)

Asthma
General population, no asthma

SHS exposure and exacerbation of pre-existing adult asthma
Ostro et al, AJRCCM 1994

Prospective cohort of 164 adult non-smokers with asthma
Age 18-70 yrs (mean 45 yrs)
Daily diary - SHS at home and work, respiratory symptoms
3 month period
Analysis using 1-day lagged exposure

SHS exposure and adult asthma status

Cough
Dyspnea
Nas. Sx
Rest. Activity

SHS and asthma exacerbation

No ETS
ETS
**SHS exposure is common in COPD**  
Eisner et al, BMC Pulmonary Medicine 2006

- **Can SHS exposure exacerbate COPD?**  
(Eisner et al, BMC Pulmonary Medicine 2006)

Survey assessed SHS during the past 7 days in 6 microenvironments: home, another person’s home, traveling in a car or vehicle, workplace, bars and nightclubs, and other locations.

- **SHS exposure, pulmonary function, and cardiovascular mortality**  
(Eisner et al, Annals of Epidemiology, in press)

**Longitudinal impact of SHS exposure on FEV₁**

1057 never smoking adults aged 53-97 yrs

P<0.05 in all cases

**The workplace – nidus for change**

Intersection of science & public policy

- SHS exposure
- Health effects
- Public policy
- Worker protection
Workplace SHS exposure – how common is it?

Determinants of workplace exposure

Time: relative person-minutes of SHS exposure in different environments
(California Time-Activity Survey 1992)

Occupation and workplace SHS exposure

Occupation and Smoke-free Workplaces

Occupation and nicotine concentration
(8-hr average, ug/m³)
(In-cities study, Jenkins et al, 1999)

Workplace smoking policy and SHS exposure

Workplace Smoking Restrictions by Degree of Strength

Workplace smoking policy and nicotine concentration
WellWorks project, Hammond et al, JAMA 1995

Workplace smoking ban and respiratory health (Eisner, JAMA 1998)
- Does SHS exposure cause respiratory symptoms and lung function impairment?
- Bartenders exposed to high SHS levels: 4-6 x other workplaces
- CA Assembly Bill 13 amended Labor Code 6404.5 - no smoking in bars and taverns 1/1/98
- Effect of reduced SHS exposure on respiratory symptoms and lung function

Study Framework

Sampling Strategy
- Random sample of SF bars and taverns
- 25 of 83 bars participated (30%)
- Interview and spirometry
- 54 of 67 bartenders who work ≥ 1 daytime shift per week completed baseline (81%)
- 53 of 54 subjects completed follow-up (98%)
Study Outcome Variables

Change in:
Respiratory symptoms - cough, wheeze, SOB
Sensory irritation symptoms - eye, nose, throat
Pulmonary function - FEV₁, FVC, FEF₂₅₋₇₅

Baseline bartender characteristics (n=53)

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<tr>
<th>Characteristic</th>
<th>Value</th>
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<tr>
<td>Age (mean, sd)</td>
<td>42.5 (14)</td>
</tr>
<tr>
<td>Gender (% F)</td>
<td>28%</td>
</tr>
<tr>
<td>Educ (some college)</td>
<td>76%</td>
</tr>
<tr>
<td>Current Bar Employment (median years, IQR)</td>
<td>3.0 (1.5-8.0)</td>
</tr>
<tr>
<td>Ever Smoked</td>
<td>76%</td>
</tr>
<tr>
<td>Current Smoking</td>
<td>45%</td>
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Respiratory and sensory irritation symptoms

<table>
<thead>
<tr>
<th>Sx (Any)</th>
<th>Baseline</th>
<th>Follow-up</th>
<th>Resolution</th>
</tr>
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<tbody>
<tr>
<td>Respiratory</td>
<td>39 (74%)</td>
<td>17 (32%)</td>
<td>59%</td>
</tr>
<tr>
<td>Sensory</td>
<td>41 (77%)</td>
<td>10 (19%)</td>
<td>77%</td>
</tr>
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p<0.001

Pulmonary Function Improvement

Scottish smoking ban in Scotland: impact on respiratory health of bartenders

Menzies et al, JAMA 2006

National smoking ban in Scotland: impact on respiratory health of bartenders

Menzies et al, JAMA 2006

N=77 bartenders
Decline in respiratory symptoms in hospitality workers after Norway smoking ban

Eagan et al, Eur Resp J 2005

Impact of Irish smoking ban on particulate pollution in 24 Dublin pubs

(McCaffrey et al, Eur Resp J 2005)

Irish smoking ban and bartender lung function 1 year later

Agnew et al, Eur Resp J 2006

Work shift changes in lung function among 26 bartenders in British Columbia

Dimich-Ward et al, 1998

Smoke-free workplace ordinance and incidence of acute MI

Sargent, BMJ 2004

Workplace SHS – policy aspects

CA statewide smoking legislation

- California Smoke-Free Workplace Law AB13
- Jan 1, 1995 prohibits smoking in most workplaces
- Jan 1, 1998 included bars and taverns
- Cosponsored by California Restaurant Association, AFL-CIO, CA medical association
- Threat of workers compensation and Americans with Disabilities Act claims
- Intersection of epidemiology and policy
- Pre-emption of local regulation
  - e.g., AB 13 excludes businesses that are solely owner operated, hotel rooms / lobbies, hotel banquet rooms, employee break rooms (direct ventilation), etc.
Compliance with CA smoke-free workplace law (Weber, Tob Cont 2003)

*proportion with no smoking patrons observed

Smoking in film
- Tough
- Sexy
- Rebellious
- Independent
- “Socially acceptable”

Hollywood – back to the past
Glantz, AJPH 2004

Tobacco use in films and adolescent smoking
Sargent, BMJ, 2001

Cross-sectional
Random sample of 419 schoolchildren 9-15 yrs

Tobacco use in films and adolescent smoking
Sargent, BMJ 2001

Cross-sectional study of 419 schoolchildren 9-15 yrs
Cross-sectional study of 419 schoolchildren 9-15 yrs

Movie smoking and adolescent smoking initiation
Dalton, Lancet 2003

3547 adolescents aged 10-14
Never smokers at baseline
Surveyed 13-26 mos later
10% initiated smoking

Relative Risk
*controlling for grade, sex, school, friend smoking, sibling smoking, parent smoking, receptivity to tobacco ads, school performance, sensation seeking propensity, rebelliousness, self-esteem, parent education, authoritative parenting, parental smoking disapproval
SHS - conclusions

- SHS exposure is common (still)
- SHS may cause new cases of asthma, COPD, and impaired lung function
- SHS exacerbates obstructive lung disease
- Worker health has been powerful force for policies prohibiting public smoking
- Film / media – a powerful contrary force
- Intersection of science & policy – epidemiologic evidence on health effects = basis for law

Coda: time to clear the air
Eisner, JAMA 2006

- Surgeon general 2006: SHS causes lung cancer, heart disease, and shortened life span
- Workplace smoking bans rapidly improve health
- Bans are effective, popular, and revenue friendly
- And people quit smoking at higher rates