Health effects of cleaning on nurses and cleaning staff

George L. Delclos, MD, MPH, PhD, Professor, Epidemiology, Human Genetics and Environmental Sciences Division, The University of Texas School of Public Health
Cleaning and Disinfection

- Important everywhere, but especially so in healthcare settings, because of healthcare-associated infections (HAIs).
- Prioritized by several agencies and organizations:
  - Joint Commission (JCAHO)
  - Centers for Disease Control and Prevention (CDC)
  - Healthcare Infection Control Practices Advisory Committee (HICPAC)
Cleaning in Healthcare Settings

Infection prevention
Infection control

Adverse health effects
Environmental impact
At-risk worker groups

- Janitors/custodians
- Housekeeping professionals, industrial and domestic
- Healthcare personnel
- ? Others
Adverse Health Effects

- Acute and chronic
- Exposure routes: respiratory and dermal
- Mechanisms: irritant and allergic
- Health effects:
  - Dermatitis (irritant and/or allergic)
  - Irritant respiratory syndromes: rhinitis, sinusitis, bronchitis, **asthma**, Others?
  - Allergic respiratory syndromes: rhinitis, sinusitis, bronchitis, **asthma**, Others?
Asthma and Healthcare Workers

Latex

Glutaraldehyde

Aerosolized medications

Cleaning
A Survey of Asthma in Health Professionals

A study funded by the U.S. Centers for Disease Control and Prevention and the National Institute for Occupational Safety and Health (CDC/NIOSH)
Asthma Risk Factor JEM

- Externally developed
- Job x practice setting by exposure category matrix
- Based on hospital walkthroughs and professional experience
- Exposures assigned by a panel of 5 experts
Asthma Risk Factor JEM

Exposure classes

- Cleaning agents
  - Patient care-related
  - Instrument cleaning/disinfection
  - Used on building surfaces

- Latex
  - < 1992
  - 1992-2000
  - > 2000

- Aerosolized medications
- Adhesives/glues/solvents/gases/vapors
  - Patient care-related
  - Used on surfaces
  - Miscellaneous

- Sensitizing metals
Asthma in HCW Study (Texas)

- Validated questionnaire
- Mail survey to four groups (n=5600) of Texas HCWs with active licenses in 2003
  - Physicians: 52,542 records
  - Nurses: 161,557 records
  - Respiratory therapists: 10,085 records
  - Occupational therapists: 7,207 records
- Overall response rate: 65%
## Asthma Prevalence

<table>
<thead>
<tr>
<th>Professional group</th>
<th>New onset asthma</th>
<th>BHR-related symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicians</td>
<td>4.2%</td>
<td>18.0%</td>
</tr>
<tr>
<td>Nurses</td>
<td>7.3%</td>
<td>29.2%</td>
</tr>
<tr>
<td>Respiratory therapists</td>
<td>5.6%</td>
<td>30.3%</td>
</tr>
<tr>
<td>Occupational therapists</td>
<td>4.5%</td>
<td>33.7%</td>
</tr>
<tr>
<td>Overall*</td>
<td>6.6%</td>
<td>27.2%</td>
</tr>
</tbody>
</table>

(*) Weighted sample
Occupational exposures and asthma among Texas healthcare workers

Final multivariable logistic regression models\(^a\) (n=2511)

<table>
<thead>
<tr>
<th>Occupational exposure</th>
<th>Bronchial hyperresponsiveness</th>
<th>New onset asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O.R.</td>
<td>95% CI</td>
</tr>
<tr>
<td>Cleaning agents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used in patient care</td>
<td>0.76</td>
<td>0.31-1.89</td>
</tr>
<tr>
<td>Instrument cleaning</td>
<td>1.34</td>
<td>1.00-1.80</td>
</tr>
<tr>
<td>Surface cleaners</td>
<td>1.58</td>
<td>1.17-2.15</td>
</tr>
<tr>
<td>Latex (powdered glove use)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-1992</td>
<td>1.17</td>
<td>0.79-1.74</td>
</tr>
<tr>
<td>1992-2000</td>
<td>1.36</td>
<td>0.99-1.88</td>
</tr>
<tr>
<td>After 2000</td>
<td>0.66</td>
<td>0.36-1.20</td>
</tr>
</tbody>
</table>

\(^a\) Adjusted for seniority, race/ethnicity, obesity, and atopy; weighted survey samples. Goodness of fit: F-adjusted mean residual test for sample survey date, p>0.05 for all models, except latex after 2000 (reported asthma).
Sample Products

Cleaning products - instrument disinfection/cleaning

- Glutaraldehyde/orthophtaldehyde
- Subtilisins
- Other irritants

Cleaning products - building surfaces

- Acetic acid
- Ammonium hydroxide
- Diethanolamine
- Hydrochloric acid
- Sulfuric acid
- Bleach
- Other irritants
## Nurses versus other HCWs
### New-onset asthma risk

<table>
<thead>
<tr>
<th>JEM Based Exposures</th>
<th>Adjusted Analysis(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cleaning-related</strong></td>
<td></td>
</tr>
<tr>
<td>Patient-care cleaning and disinfection</td>
<td>2.73</td>
</tr>
<tr>
<td>Instrument cleaning and disinfection</td>
<td>1.67</td>
</tr>
<tr>
<td>Building surfaces cleaning &amp; disinfection</td>
<td>1.72</td>
</tr>
<tr>
<td><strong>Latex use</strong></td>
<td></td>
</tr>
<tr>
<td>Use of Powdered latex gloves before 1992</td>
<td>1.68</td>
</tr>
<tr>
<td>Use of Powdered latex gloves b/w 1992 – 2000</td>
<td>1.59</td>
</tr>
<tr>
<td>Use of Powdered latex gloves after 2000</td>
<td>0.80</td>
</tr>
<tr>
<td><strong>Exposure to aerosolized medication</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Adhesives/solvents</strong></td>
<td></td>
</tr>
<tr>
<td>Patient care</td>
<td>1.36</td>
</tr>
<tr>
<td>On surfaces</td>
<td>1.23</td>
</tr>
</tbody>
</table>

\(^1\) Adjusted for age, sex, ethnicity, atopy, smoking, body mass index, and seniority.

Other Considerations

• Other at-risk groups (e.g., cleaning professionals) (Medina-Ramon, 2003, 2005, 2006)
• Specific compounds (e.g., bleach, ammonia) (Medina-Ramon, 2005; Mirabelli, 2007)
• Mode of application: sprays (Medina-Ramon 2006; Zock 2007, 2010)
Conclusions

• Occupational exposures to cleaning products are a determinant of asthma among healthcare workers.

• The risk is clear with respect to:
  – Cleaning and disinfection of medical instruments
  – Cleaning products used for general surfaces (floor, bathrooms, countertops, etc.)
Conclusions

• Research on cleaning products should build on previous approaches to exposure assessment by considering:
  – Better personal exposure measurements
  – Physical and chemical characteristics of the cleaning product
  – Cleaning tasks
  – Form of cleaning product application
  – Environment in which cleaning products are used
  – Trends (historical and future) in use of cleaning products
Thanks.