Methamphetamine Residue Transfer Efficiencies from Household Surfaces

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RT 225: Methamphetamine Labs: Current Issues
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Introduction

• Methamphetamine Symptoms
• Methamphetamine Contamination
• Laboratory Studies
  - Characterization of panel surfaces
  - Characterization of hand surface area
  - Dermal sampling
  - Dermal transfer analysis
  - Exposure analysis
• Conclusions
Methamphetamine Symptoms

- Little known regarding chronic low level exposures
- Irritation of skin, eyes, mucous membranes, upper respiratory tract
- High levels may cause dizziness, headache, metallic taste, insomnia, high or low blood pressure, etc.
- Chronic exposures may cause irritability, personality changes, anxiety, hallucinations, psychotic behavior
- Smaller infants, altered behavior patterns, lower IQ scores, teratogenic affects, cerebral hemorrhage
Methamphetamine Release

- Methamphetamine released mainly during “salting out” phase but also during “cooking” phase
- Methamphetamine also released during “smoking”
Meth Surface Contamination

• Current Standards
  – Surface contamination: 0.05-1.5 µg/100 cm²
    • CA 1.5 µg/100 cm²
    • CO 0.5 µg/100 cm²

• Real Labs
  – Ranged from non-detect to 16,000 µg/100 cm²
  – Average: 499 µg/100 cm²

• Controlled Cooks
  – < 2 meters from cook area – average 101 µg/100 cm²
  – 2 to 4 meters from cook area – average 41 µg/100 cm²

• Simulated Smoking
  – Surface areas throughout the room were contaminated with up to 35 µg/100 cm²
Problem Not Isolated by Geography
Concern

• Residents post-meth lab
• First responders
• Social workers
• Vulnerable residents
  – About 30-35% of labs seized are residences with children
  – 35% - 55% of children removed from meth labs test positive for meth
  – 10% of children removed from homes of heavy users test positive for meth

Photo by North Metro Drug Task Force
Household Surface Contamination

- Stainless steel exposure chamber
- 400 mg street grade methamphetamine
- 450°C
- 10-20 minutes

Photo by National Jewish Health
Household Materials

- Carpet
- Drywall
- Linoleum
Methods: Characterization of Panel Surfaces

- **Wipe Samples**
  - Carpet
  - Drywall
  - Linoleum

- **Bulk Samples**
  - Carpet
  - Drywall
  - Linoleum

- **NIOSH 9111**
# Results: Characterization of Panel Surfaces

<table>
<thead>
<tr>
<th>Surface Type</th>
<th>N</th>
<th>Mean</th>
<th>Range</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpet</td>
<td>36</td>
<td>27</td>
<td>5.4-70</td>
<td>17</td>
</tr>
<tr>
<td>Drywall</td>
<td>48</td>
<td>6.6</td>
<td>2.7-29</td>
<td>4.3</td>
</tr>
<tr>
<td>Linoleum</td>
<td>48</td>
<td>15</td>
<td>5.0-36</td>
<td>8.5</td>
</tr>
</tbody>
</table>

$p < 0.05$
Methods: Characterization of Hand Surface Area

- Tempura paint
  - Smooth surface
  - Carpeted surface
- 5.4 kg force
- Hand area analyzed
  - Image J

Photo by National Jewish Health
Methods: Dermal Sampling

- Cotton Gloves
- Two Hand Conditions (glove)
  - Dry
  - Simulated Saliva (wet)
- Multiple Contacts
  - 1, 2, or 3
- NIOSH 9111

Photo by National Jewish Health
Methods: Dermal Transfer Analysis

- Dermal Transfer Efficiency
  \[ TE = \frac{m_p}{SA_T} / SL \]
- Lognormal
- ANOVA

Photo by National Jewish Health
## Results: Dermal Transfer Analysis

<table>
<thead>
<tr>
<th>Skin Condition</th>
<th>Dry Glove</th>
<th>Wet Glove</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Contacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>GM</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GM</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GM</td>
<td></td>
</tr>
<tr>
<td>1 Contact All Surfaces Combined</td>
<td>GM</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Carpet</th>
<th>Drywall</th>
<th>Linoleum</th>
<th>Carpet</th>
<th>Drywall</th>
<th>Linoleum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.16</td>
<td>0.24</td>
<td>0.25</td>
<td>0.71</td>
<td>0.36</td>
<td>0.50</td>
</tr>
<tr>
<td>2</td>
<td>0.19 (2.3)</td>
<td>0.27 (1.6)</td>
<td>0.24 (1.4)</td>
<td>0.55 (1.6)</td>
<td>0.42 (1.8)</td>
<td>0.57 (1.2)</td>
</tr>
<tr>
<td>3</td>
<td>0.28</td>
<td>0.20</td>
<td>0.22</td>
<td>0.54</td>
<td>0.38</td>
<td>0.55</td>
</tr>
<tr>
<td>1 Contact All Surfaces Combined</td>
<td>GM</td>
<td>0.22</td>
<td>0.49</td>
<td>0.36</td>
<td>0.50</td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05*
Methods: Dermal Exposure Analysis

- Stochastic Human Exposure and Dose Simulation for multimedia (SHEDS-Multimedia)
  - Absorbed dose estimates
    - Many inputs
      - How & when contaminated
      - Surface loading methamphetamine
      - Dermal transfer efficiency (TE)
      - Exposure factors

**TE Parameters:**
- Default: CA OEHHA
- Our TE data
  - Wet gloves
  - Dry gloves

**Surface Level Concentrations:**
- 0.1 µg/100 cm²
- 0.2 µg/100 cm²
- 0.5 µg/100 cm²
- 1.5 µg/100 cm²
Results: Exposure Analysis

Absorbed Dose Estimates from SHEDS-Multimedia

![Chart showing absorbed dose estimates]

- Absorbed Dose Estimates
- Mean and 95th Percentile
- RfD = 0.3 mg/kg/day
- Surface Contamination Concentration (µg/100 cm²)
- Residue-Skin Transfer Efficiency Parameter
Take Home Points

• Wet TE > dry TE for all surfaces
• Wet TE on carpet > drywall
• Wet TE > dry TE for all surfaces combined
• Contamination levels of 1.5 and 0.5 µg/100 cm² resulted in predicted absorbed doses > RfD
• Recommended surface cleanup level:
  0.2 µg/100 cm²
Acknowledgments

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Questions?

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