Evidence-based risk assessment - clandestine drug laboratories and potential community impacts

John Edwards
Dept Environmental Health
Flinders University
Background

• Occupational hygiene
  • COH

• Occupational and environmental toxicology
  • UK/European Register
  • ACTRA

• Academic/research environmental health
Acknowledgements

- David Caldicott, RAH
- Paul Pigou, Dept Forensic Science
- Rob Beattie, SAPOL
- Johannes Kutzler
- Carly Light
- Catherine Jones
- Tamara al Obaidi
History

• First amphetamine laboratory in US in 1963
  • Usually small scale
  • Remote areas
  • Detections as a result of ‘incidents’
• In Australia in 1976
  • Increasing numbers of seized laboratories
Clandestine laboratory data 2002–03 by drug type manufactured

- Amphetamine: 79%
- Cannabis: 7%
- Fantasy: 3%
- Heroin: 4%
- MDMA: 1%
- Methylamphetamine: 1%
- Other: 1%
- Precursors: 1%
Clandestine laboratory data 2002–03 by drug manufacturing method

- Benzyl Piperazine BZP: 9%
- Nazi: 4%
- Other: 4%
- Home Bake - Acetic anhydride: 3%
- Hypophosphorous: 2%
- Not known: 1%
- P2P: 1%
- Pseudo Extraction: 1%
- Red Phosphorous: 60%
Where do we find clandestine drug laboratories?

- Urban and rural locations
- SA in 2003, 67% urban
  - Homes
  - Motels/hotels
  - Campgrounds
  - Ministorage buildings
  - Caravans
  - Trucks and trailers
  - Car boot
  - Garages
  - Sheds
## Detections in Australia

<table>
<thead>
<tr>
<th>Year</th>
<th>NSW</th>
<th>VIC</th>
<th>QLD</th>
<th>WA</th>
<th>SA</th>
<th>ACT</th>
<th>NT</th>
<th>TAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>20</td>
<td>4</td>
<td>83</td>
<td>8</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>20</td>
<td>18</td>
<td>79</td>
<td>17</td>
<td>19</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2001</td>
<td>42</td>
<td>32</td>
<td>77</td>
<td>22</td>
<td>31</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2002</td>
<td>32</td>
<td>24</td>
<td>138</td>
<td>22</td>
<td>31</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2003</td>
<td>56</td>
<td>22</td>
<td>162</td>
<td>39</td>
<td>52</td>
<td>0</td>
<td>12</td>
<td>3</td>
</tr>
</tbody>
</table>
Are these data reasonable estimates of prevalence?

- In SA 2003, over 60% of lab discoveries by police as a result of routine or other policing activity
- In Queensland, police suggest about 80% of detections are by chance
- How severe is our underestimate of the number of laboratories?
Toxic effects of chemicals used

- Methanol, ethanol, acetone
  - Explosion/fire
- Toluene, xylene, benzene, ether
  - Explosion, inhalation (organ damage)
- Red phosphorus
  - Explosion. May yield white phosphorus. May produce phosphine
  - Explosion, burns, systemic injury
• **Hydriodic/hypophosphorus acids**
  • Corrosive, skin absorption, irritation, teratogenic. Heating generates phosphine

• **Sulphuric and hydrochloric acids**
  • Corrosive, irritant

• **Lithium, sodium etc**
  • Fire, burns, eye injury
• Iodine
  • Reactive, sublimates, skin contact
    – Corrosive, systemic toxin
• Ammonia, sodium hydroxide
  – Irritants, corrosives, toxic by inhalation and skin contact
• $\alpha$-benzylphenethyamine derivatives
  common contaminant – seizure potential
Risks faced by cooks and residents

- From release to air
  - Inhalation (death bag)
  - Explosion and fire
- Skin contact
- May persist
- Chemicals ‘hoarding’
Risks to emergency and other responders

• Police, ambulance, fire services
  – Shutdown procedures
  – Reduce emissions and runaway reactions
  – Remove materials

• Chance discoveries

• Chemicals as weapons
Risks to others in the community

• Neighbours
  – Fire and explosion
  – Inhalation of byproducts
  – Contamination of surfaces
  – Soil
  – Garbage
  – Water/wastewater
Where do we find clandestine drug laboratories?

- About 25% of seized laboratories in Housing SA properties
- Currently about 60/year total in SA
Housing SA methamphetamine laboratory prevalence survey

- About 4000 HousingSA vacancies per year
- Originally aimed to examine 400, but revised to 200
- Sample prior to refurbishment
- Proportional sampling plan (consistent with Housing SA stock distribution)
- Single MethChek analysis (50 ng/100cm²)
- Single financial year (July-June)
What will this show?

- Current best estimate of prevalence is from SAPOL data/notifications
- About 15/year
- If only a single positive is found (/400) this suggests;
  - 0.25% positive
  - Possibly 100 Housing SA premises
  - Overall 400 in Metro area (total)
Current status

• 177/200 completed
  – 38/48 Southern
  – 29/56 Western
  – 36/21 Eastern
  – 37/75 Northern

• ONE positive
  – Not suggesting 800 laboratories
  – More confidence of likelihood of 400
    Poisson distributed data)
How reliable are these data?

- Assuming 100 labs in 40,000 properties
- Chance of finding 1 +ve from sample of 400 is 0.0025
- Chance of finding negative is 0.9975
- Chance of finding 2 is 0.000003

- Errors?
How reliable are these data?

- **Underestimation factors**
  - Only one sample per property (judgement)
  - Only meth tested
  - Only 400 out of 4000 vacancies

- **Overestimation factors**
  - Only in vacant homes (homes with high turnover may be more likely to hold a laboratory)
  - Assume 25% in Housing SA properties
How we can use these data

- Housing SA
  - Planning for financial commitment to remediation
  - Improve vigilance of Housing SA officers
- SAPOL
  - Determine true scale of issue in SA
  - Target resources
Positive Drug laboratory assessments

- SAPOL notify HousingSA of laboratory detections in Housing SA stock
- Need for assessment and remediation
- Training in risk assessment is essential
- Need to develop a useable tool for assessments
  - Housing SA officers to use when possible
Property assessment

- Focus on
- Methchek analysis
  - Target to areas of likely positive
- Some air analysis
- Observational skills
  - Scorch marks, stains etc
- Property design features
  - Open plan/corridors/construction material
Findings

• 12 properties assessed in detail in 2009/2010
• Report available (with caveats)
• Positive methchek test
  – Can determine severity of contamination
    • Amount
    • Extent and spread
  – Doors and passageways limit spread
• Remediation options can be based on observations
Risk assessment – a way forward

- Training in risk assessment is essential
  - Whether to do it at all
  - Gradings of complexity

- Need to provide a score system for observations to assist assessors

- Provided advice for remediation consistent with EPA guidelines
Do remediation methods work?

• Wash methods
  – (scrub methods)
• Paint/encapsulation
• Strip and refit
• Evidence-based approach
Assessment of cleaning methods

- Gyprock panels (600 mm square)
- Painted using HousingSA materials
- Grid pattern (5 x 5)
- Applied methamphetamine spray
- Can test for persistence, washing methods etc
water

detergent

acetone

Acetic acid
Standard cleaning methods....

• Do not work.....
Domestic bleach

Inexpensive

Available

EPA guidelines suggest to AVOID bleach as secondary chemical products may be formed.
But...

- 100% bleach effective in removing 500 ng/100 sq cm (to below 50 ng/100 sq cm)
- 50% bleach effective
- 25% bleach effective
- 10% bleach effective after 2 washes
Community Risk assessment

- Project in 2008 - 2010 mapping methamphetamine laboratories detected in Adelaide since 2002
- Includes data on chemicals present and quantities
- Examines nearby groups at risk
- Almost complete (May 2010)
Emerging and future developments

- CRC in Meth laboratories
  - Flinders University
  - Forensically driven
  - Scope for risk assessment section
  - Industry partners + Commonwealth funding
- Undergraduate and Honours projects
  - PhD in Meth labs
Projects planned

- Police and first responders health assessments/surveillance
- Skin and eye injury in cooks
- Simple detection methods for ancillary chemical exposures
- Changes in manufacture methods
- Children in meth labs
Going to send your kids out to the street to sell something they made themselves at home?
Forget the lemonade stand.
Now they can learn the fun of science while saving up for a college education.
Maybe a new car...
Or just some kick ass bling bling.

**MY FIRST METH LAB**

Every kid needs a hobby.
<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>N incidents</td>
<td>8,971</td>
<td>13,270</td>
<td>15,353</td>
<td>14,260</td>
</tr>
<tr>
<td>Incidents with children</td>
<td>1,803</td>
<td>2,191</td>
<td>2,077</td>
<td>1,442</td>
</tr>
<tr>
<td>N children living in labs</td>
<td>216</td>
<td>976</td>
<td>2,023</td>
<td>1,447</td>
</tr>
<tr>
<td>Children affected**</td>
<td>1,803</td>
<td>2,191</td>
<td>3,167</td>
<td>3,419</td>
</tr>
<tr>
<td>Children exposed to toxics</td>
<td>345</td>
<td>788</td>
<td>1,026</td>
<td>724</td>
</tr>
<tr>
<td>Children inj:killed</td>
<td>12:3</td>
<td>14:0</td>
<td>26:2</td>
<td>44:3</td>
</tr>
</tbody>
</table>

2001/2003 incomplete
• Children in SA
  • 2003 data
    • Children at 8/46 labs and evidence of children at others

• Children at greater risk
  – Greater body size:weight ratio
    • Greater relative dose
  – Formative period
    • biochemical, hormonal, neurological
• Children may be a specific sensitive subgroup
  – Exposure to chemicals
  – Needlestick and other punctures
  – Physical and sexual abuse
  – Neglect etc during withdrawal
Where do we go from here?

• Range of personnel may need to know
  • EHOs, ambulance, GP, fire, police

• Research perspective
  • Hazards are known, but we do not know about the amounts and distribution of chemicals
  • More advice to doctors and hospitals in recognition of drug-related injury
  • Other agency partnerships