Rationale for a Focus on Reducing Pharmaceuticals In The Environment

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Impact of Unused Pharmaceuticals

• Childhood poisoning
• Theft, misuse, abuse
• Excessive accumulation of unwanted drugs
• Unintended environmental exposure
• Inappropriate international donations
Childhood Poisoning

- 2,500,000 human exposures in 2005 (AAPCC),
  - (8.2 exposures per thousand population)

- 51% of all poisoning exposures were due to pharmaceuticals
  - 41.6% involved children less than 6 years of age
  - 14.9% involved minors aged 6 to 19 years.
  - 34% involved adults over 20 years of age.
    - (AAPCC)
Increases in Prescriptions

• Number of prescriptions written for non-controlled drugs
  – increased 57%

• Number of prescriptions filled for controlled drugs
  – increased 154%
    – National Center on Addiction and Substance Abuse at Columbia University (CASA)

• Overall Population growth in the US between 1992 and 2003
  – Increased 13%
Increased Abuse

- Number of people admitted to hospitals abusing controlled prescription drugs
  - Increased 90%
- Among 12 to 17 year olds
  - Increased 203%
- Among those greater than 18-years old
  - Increase 78%

  – National Center on Addiction and Substance Abuse at Columbia University (CASA)
Abuse and Misuse

Between 1992 and 2003

• Teenage use of Alprazolam, oxycodone, and methylphenidate
  – Increase 212%

• Teenagers addicted to opioids, CNS depressants or stimulants
  – Increased 15%

• Total # of Americans abusing controlled prescription drugs
  – 15.1 million
    • Exceeds the combined number abusing
      – cocaine (5.9 million),
      – hallucinogens (4.0 million),
      – inhalants (2.1 million)
      – heroin (.3 million).
Prescription Drug Abuse

Substances involved in Substance Abuse Questions from 2001 - 2006
Top 10 Categories Only
Northern New England Poison Center’s SASRS Database

N = 68,792

Count

Group Name
- Opioids
- Benzodiazepines/Benzodiazepine-like
- Non-Opioid Analgesics without sedatives (aspirin, Tylenol®)
- Unknown Drug
- Antidepressants
- Cardiovascular (Heart)
- Skeletal Muscle Relaxants
- Stimulants and Street Drugs
- Antibiotics and Other Anti-infectives, Vaccines
- Other Drug (Chemotherapy, Radiopharmaceuticals, Diagnostic, Hormones, Antidiabetic, Antithyroid)
The ONDCP recognizes the connection between the accumulation of medicines in the home and the potential for diversion and abuse.

- Hydrocodone and oxycodone are implicated in 28% of all drug related crime.
- Methylphenidate and dextromethorphan are implicated in 19% of all drug related crime.
Excessive Accumulations

- **Number of Medications Respondent’s Household Members Have**

<table>
<thead>
<tr>
<th>Number</th>
<th>Prescription</th>
<th>Nonprescription</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17.1%</td>
<td>11.7%</td>
</tr>
<tr>
<td>2</td>
<td>19.3%</td>
<td>13.0%</td>
</tr>
<tr>
<td>3</td>
<td>16.6%</td>
<td>15.6%</td>
</tr>
<tr>
<td>4</td>
<td>13.2%</td>
<td>12.6%</td>
</tr>
<tr>
<td>5–7</td>
<td>21.1%</td>
<td>23.8%</td>
</tr>
<tr>
<td>8+ 12.</td>
<td>8%</td>
<td>23.3%</td>
</tr>
<tr>
<td>Mean</td>
<td>4.4</td>
<td>5.5</td>
</tr>
<tr>
<td>Std. Dev</td>
<td>(3.8)</td>
<td>(4.4)</td>
</tr>
</tbody>
</table>

What is Accumulating?

### TABLE L2. Top Therapeutic Class

<table>
<thead>
<tr>
<th>Therapeutic Class</th>
<th>Items</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory Agents</td>
<td>1623</td>
<td>19.9%</td>
</tr>
<tr>
<td>CNS Agents</td>
<td>1358</td>
<td>16.6%</td>
</tr>
<tr>
<td>Topical Agents</td>
<td>993</td>
<td>12.2%</td>
</tr>
<tr>
<td>Psychotherapeutic Agents</td>
<td>809</td>
<td>9.9%</td>
</tr>
<tr>
<td>Gastrointestinal Agents</td>
<td>607</td>
<td>7.4%</td>
</tr>
<tr>
<td>Nutritional Products</td>
<td>592</td>
<td>7.2%</td>
</tr>
<tr>
<td>Cardiovascular Agents</td>
<td>537</td>
<td>6.6%</td>
</tr>
<tr>
<td>Anti-Infectives</td>
<td>536</td>
<td>6.6%</td>
</tr>
<tr>
<td>Hormones</td>
<td>330</td>
<td>4%</td>
</tr>
<tr>
<td>Metabolic Agents</td>
<td>288</td>
<td>3.5%</td>
</tr>
<tr>
<td>Alternative Medicines</td>
<td>221</td>
<td>2.7%</td>
</tr>
<tr>
<td>Miscellaneous Agents</td>
<td>137</td>
<td>1.7%</td>
</tr>
<tr>
<td>Coagulation Modifiers</td>
<td>79</td>
<td>1%</td>
</tr>
<tr>
<td>Anti-neoplastics</td>
<td>32</td>
<td>0.4%</td>
</tr>
<tr>
<td>Immunologic Agents</td>
<td>28</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

- Kreisberg & Ruhoy, *Bay Area Medication Disposal Survey 2009*
What is Accumulating?

– Kreisberg & Ruhoy, *Bay Area Medication Disposal Survey 2009*

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<table>
<thead>
<tr>
<th>Top 11 Generics</th>
<th>Items</th>
<th>Est. %</th>
<th>Therapeutic Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol</td>
<td>512</td>
<td>6.4%</td>
<td>Respiratory Agents</td>
</tr>
<tr>
<td>Acetaminophen</td>
<td>440</td>
<td>5.5%</td>
<td>CNS Agents</td>
</tr>
<tr>
<td>Ipratropium</td>
<td>417</td>
<td>5.2%</td>
<td>Respiratory Agents</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>151</td>
<td>1.9%</td>
<td>CNS Agents</td>
</tr>
<tr>
<td>Aspirin</td>
<td>119</td>
<td>1.5%</td>
<td>CNS Agents</td>
</tr>
<tr>
<td>Multi-vitamin</td>
<td>113</td>
<td>1.4%</td>
<td>Nutritional Products</td>
</tr>
<tr>
<td>Naproxen</td>
<td>109</td>
<td>1.4%</td>
<td>CNS Agents</td>
</tr>
<tr>
<td>Fluticasone</td>
<td>95</td>
<td>1.2%</td>
<td>Topical Agents</td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>94</td>
<td>1.2%</td>
<td>Psychotherapeutic Agents</td>
</tr>
<tr>
<td>Olanzapine</td>
<td>88</td>
<td>1.1%</td>
<td>Psychotherapeutic Agents</td>
</tr>
<tr>
<td>Potassium Chloride</td>
<td>78</td>
<td>1%</td>
<td>Nutritional Products</td>
</tr>
</tbody>
</table>
Environmental Exposures

- **Prozac** and **Luvox** induced spawning in bivalves at significantly low concentrations.

- **Fluoxetine** enhances the release of ovary-stimulating hormones in crayfish.
  - Fong PP. Zebra mussel spawning is induced in low concentrations of putative serotonin reuptake inhibitors. The Biological Bulletin. 1998;194:143-149.

- **SSRIs** elicit aggressive behavior in lobsters, causing subordinates to engage in fighting against the dominant member, and reducing the propensity to retreat.

- **Diclofenac** has been proven to be toxic to vultures, decimating populations in the Indian subcontinent due to its ubiquitous use in cattle.
Inappropriate Humanitarian Drug Donations

• Armenia, 1988

5,000 tons of drugs and medical supplies worth US$ 55 million were sent.

– It took 50 people six months to gain a clear picture of the drugs that had been received.

• Eight percent of the drugs had expired on arrival
• 4% were destroyed by frost.
• 88%, only 30% were easy to identify
• 42% were relevant for an emergency situation.
Inappropriate Humanitarian Drug Donations

• France, 1991
Pharmaciens Sans Frontières collected 4 million kg of unused drugs from 4,000 pharmacies in France.
  – These were sorted out in 88 centres in the country.
  – Only about 20% could be used for international aid programmes
  – 80% were burnt
Conclusion

• Reducing pharmaceuticals entering the environment at all levels of healthcare delivery will have personal, social and environmental benefits.

• by reducing the unintended consequences that occur when pharmaceuticals are left unattended.