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**INTER-AMERICAN DRUG ABUSE
CONTROL COMMISSION
CICAD**

Secretariat for Multidimensional Security

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TOXIC ADULTERANTS AND PUBLIC HEALTH IMPLICATIONS

Toxic Adulterants and Public Health Implications

CICAD 57

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Bureau of International Narcotics and Law Enforcement Affairs

U.S. Department of State

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Cocaine Manufacturing Process...

Coca Leaves



- Calcium Oxide
- Kerosene
- Sulfuric Acid (Battery Acid)
- Sodium carbonate



Cocaine Paste Base

- Sulfuric Acid
- Potassium permanganate
- Ammonium Hydroxide

- Hydrochloric Acid
- Sodium carbonate

Cocaine Base

- Hydrochloric Acid
- Sodium carbonate
- Heat/Cool



"Merla"



"Crack"

- Hydrochloric Acid
- Sodium carbonate

- Acetone
- Hydrochloric Acid

"Free-Base"

- Ammonium Hydroxide

Cocaine Hydrochloride

- Sodium carbonate
- Heat/Cool



1 kg Brick of Cocaine
Photo by StreetDrugs.org, Used with permission

SOME COCAINE BY-PRODUCTS

- Kerosene
- Gasoline
- Battery Acid
- Lime
- Benzene
- Potassium Permanganate
- Toluene



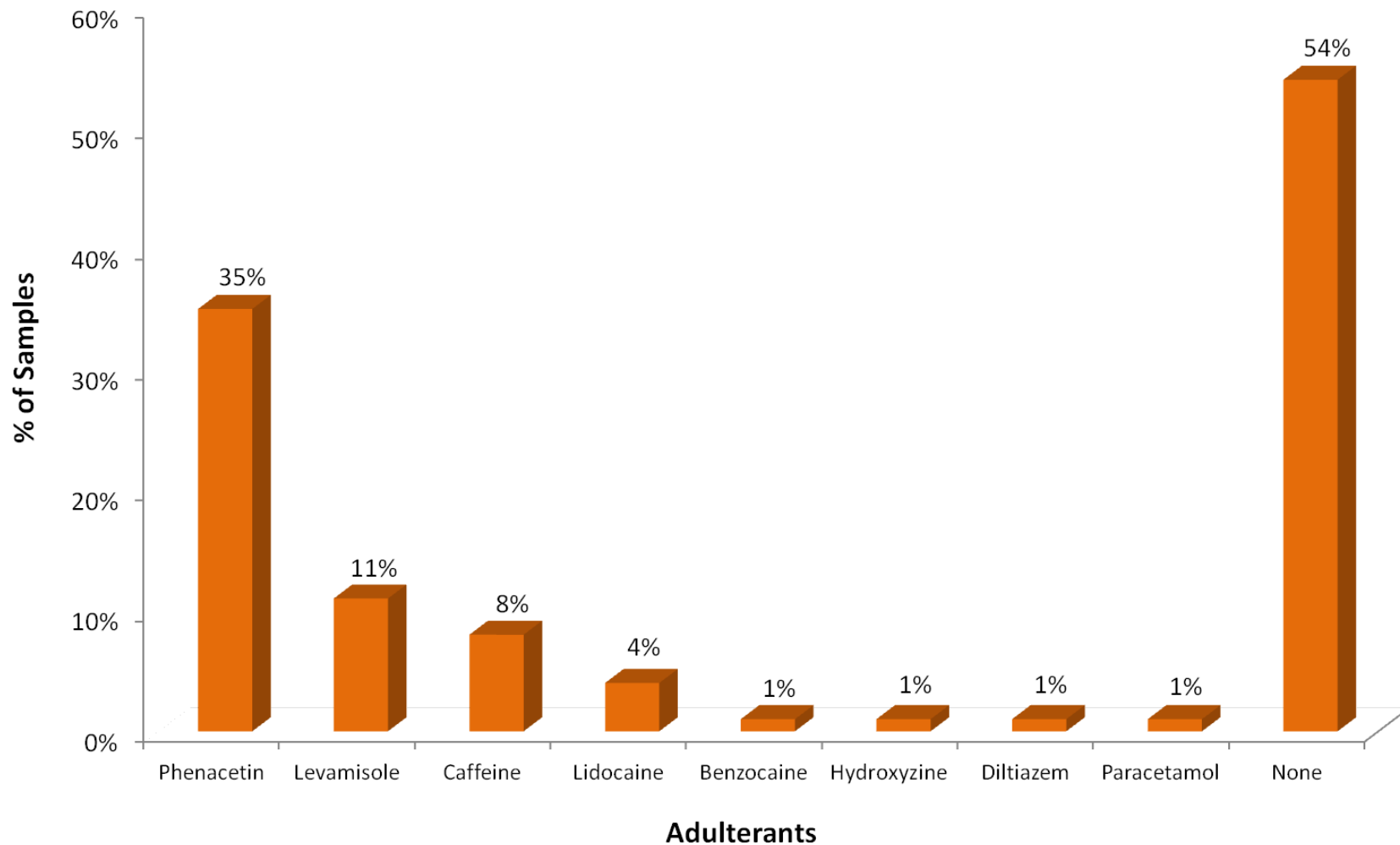
Some Cocaine Adulterants

- **PHENACETIN**: pain reliever / fever reducer
- PARACETAMOL: a pain reliever
- **AMINOPYRINE**: analgesic, anti-inflammatory
- ANFEPRAMONA: similar to amphetamine
- BENZOCAINA: a local anesthetic
- LIDOCAINA: a local anesthetic
- **LEVAMISOLE**: used to expel parasitic worms
- HYDROXYZINE: an antihistamine
- ACETAMINOPHEN: pain reliever / fever reducer

Chemical Profile of Cocaine Samples – Brazil 2012

Presence of Adulterants in the Total Number of Analyzed Cocaine Samples

(n = 160)



Chemical Profile of Cocaine Samples in the Southern Cone - 2012

| | Brazil | Chile | Paraguay | Uruguay | Argentina |
|------------------------------------|----------------|-----------------|----------------|-----------------|-----------------|
| No. Samples Tested: | 40 | 20 | 20 | 9 | 15 |
| Average Purity (Range) | (29.7% -89.6%) | (15.8% - 92.2%) | (4.6% – 84.6%) | (35.8% - 82.4%) | (17.4% - 18.4%) |
| Number (%) with Adulterants | 30 (75%) | 8 (40%) | 17 (85%) | 9 (100%) | 15 (100%) |
| Phenacetin | 26 (65%) | 1 (5%) | 13 (65%) | 2 (22%) | 15 (100%) |
| Levamisole | 1 (3%) | | 1 (5%) | 2 (22%) | |
| Other | 3 (7%) | 7 (35%) | 3 (15%) | 5 (55%) | |
| Aminopyrine + Phenacetin | 16 (40%) | - | 8 (40%) | 1 (11%) | |

Chemical Profile of Cocaine Samples in Sao Paulo – Nov. 2014 (1144 samples)

| Adulterants | Crack | HCl |
|-------------|-------|-----|
| Phenacetin | 60% | 6% |
| Aminopyrine | 25% | 1% |
| Levamisole | 1% | 50% |

| | Amostras | Forma | Benzo caina | Parace tamol | Fenace tina | Cafei na | Lido caina | Amino pirina | Leva misol | Procai na | Hidroxi zina | Dilitia zem | Cocaina | Cis-cinamoil cocaina | Trans-cinamoil cocaina |
|----|---------------|-------|-------------|--------------|-------------|----------|------------|--------------|------------|-----------|--------------|-------------|---------|----------------------|------------------------|
| 57 | 2604_11_PR_3 | Base | 0,0 | 0,0 | 20,3 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 54,3 | 0,0 | 2,7 |
| 58 | 2604_11_PR_4 | Base | 0,0 | 0,0 | 11,8 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 62,4 | 0,7 | 2,2 |
| 59 | 2604_11_PR_5 | Base | 0,0 | 0,0 | 12,2 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 62,7 | 0,5 | 3,1 |
| 60 | 2604_11_PR_6 | Base | 0,0 | 0,0 | 12,8 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 62,0 | 0,8 | 2,0 |
| 61 | 2604_11_PR_7 | Base | 0,0 | 0,0 | 12,5 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 63,6 | 0,9 | 1,7 |
| 62 | 2604_11_PR_8 | Base | 0,0 | 0,0 | 12,6 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 65,2 | 1,0 | 1,3 |
| 63 | 2604_11_PR_9 | Base | 0,0 | 0,0 | 10,6 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 61,3 | 0,8 | 2,1 |
| 64 | 3457_11_PR_2 | Base | 0,0 | 0,0 | 47,2 | 0,0 | 0,0 | 17,0 | 0,0 | 0,0 | 0,0 | 0,0 | 12,9 | 0,0 | 3,8 |
| 65 | 3457_11_PR_3 | Base | 0,0 | 0,0 | 47,3 | 0,0 | 0,0 | 16,9 | 0,0 | 0,0 | 0,0 | 0,0 | 12,0 | 0,0 | 3,9 |
| 66 | 3457_11_PR_4 | Base | 0,0 | 0,0 | 58,4 | 0,0 | 0,0 | 1,8 | 0,0 | 0,0 | 0,0 | 0,0 | 27,1 | 0,0 | 0,0 |
| 67 | 3457_11_PR_4 | Base | 0,0 | 0,0 | 13,6 | 0,0 | 0,0 | 2,3 | 0,0 | 0,0 | 0,0 | 0,0 | 71,1 | 2,4 | 1,7 |
| 68 | 3457_11_PR_6 | HCl | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 94,7 | 1,4 | 1,2 |
| 69 | 3457_11_PR_7 | Base | 0,0 | 0,0 | 13,9 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 66,6 | 0,8 | 1,4 |
| 70 | 3457_11_PR_8 | Base | 0,0 | 0,0 | 48,8 | 0,0 | 0,0 | 16,0 | 0,0 | 0,0 | 0,0 | 0,0 | 15,9 | 0,0 | 2,7 |
| 71 | 3457_11_PR_9 | HCl | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 94,4 | 1,3 | 0,0 |
| 72 | 3457_11_PR_10 | Base | 0,0 | 0,0 | 32,6 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 53,4 | 1,2 | 1,4 |
| 73 | 3461_11_PR_1 | Base | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 72,6 | 1,9 | 1,3 |
| 74 | 3461_11_PR_2 | Base | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 79,2 | 3,6 | 2,5 |
| 75 | 3461_11_PR_3 | Base | 0,0 | 0,0 | 8,4 | 0,0 | 0,0 | 17,3 | 0,0 | 0,0 | 0,0 | 0,0 | 52,8 | 0,8 | 0,0 |
| 76 | 3461_11_PR_4 | Base | 0,0 | 0,0 | 8,1 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 72,0 | 1,3 | 1,7 |
| 77 | 3461_11_PR_5 | Base | 0,0 | 0,0 | 7,7 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 74,9 | 1,3 | 2,7 |
| 78 | 3461_11_PR_6 | Base | 0,0 | 0,0 | 8,5 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 74,9 | 1,6 | 2,2 |
| 79 | 3461_11_PR_7 | Base | 0,0 | 0,0 | 8,3 | 0,0 | 0,0 | 17,2 | 0,0 | 0,0 | 0,0 | 0,0 | 50,2 | 0,7 | 0,8 |
| 80 | 3738_11_PR_1 | Base | 0,0 | 0,0 | 17,9 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 66,6 | 4,5 | 4,7 |
| 81 | 3738_11_PR_10 | Base | 5,1 | 0,0 | 26,9 | 0,0 | 0,0 | 3,4 | 0,0 | 0,0 | 0,0 | 0,0 | 47,0 | 1,6 | 2,1 |
| 82 | 3738_11_PR_11 | HCl | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 95,6 | 1,3 | 1,1 |
| 83 | 3738_11_PR_12 | HCl | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 96,0 | 1,2 | 1,3 |
| 84 | 3738_11_PR_13 | HCl | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 96,0 | 1,2 | 1,1 |
| 85 | 3738_11_PR_2 | Base | 3,0 | 0,0 | 29,3 | 0,0 | 0,0 | 3,7 | 0,0 | 0,0 | 0,0 | 0,0 | 47,6 | 1,6 | 2,3 |

Health Consequences of Cocaine Adulterants

| Adulterant | Licit Use | Potential Reason for use as Adulterant | Public Health Risks | Health Consequences |
|-------------|---|---|--|---|
| Phenacetin | Analgesic substance | Pain relieving properties; similar physical properties to cocaine | Banned in many countries due to links with renal failure and suspected carcinogen | <ul style="list-style-type: none"> •Hemolytic anemia (< red blood cells) •Kidney Failure •Bladder Cancer |
| Levamisole | Medication used for expelling worms | Unknown; may give more intense high | Highly toxic; generally not used with humans; still used in veterinary medicine | <ul style="list-style-type: none"> •Fever •Agranulocytosis (< white blood cells) |
| Lidocaine | Local anesthetic | Similar, but stronger, anesthetic effects as cocaine; gives impression of higher quality of cocaine | Adverse cardiovascular and CNS reactions at low dose; Overdose can occur at excessive doses; Increases toxicity of cocaine | <ul style="list-style-type: none"> •CNS Problems •Nausea •Vomiting •Dizziness •Tremors •Convulsions |
| Benzocaine | Local anesthetic used in dentistry, throat sprays, ointments and suntan lotions | Similar anesthetic properties as cocaine | Overdose can cause rare but serious blood disorder | <ul style="list-style-type: none"> •Blood disorder (Methemoglobinemia: inability to release oxygen effectively to body tissues) |
| Aminopyrine | Analgesic Anti-inflammatory | Pain relieving properties | Clinical use sharply curtailed due bone marrow toxicity; Emits toxic fumes when heated | <ul style="list-style-type: none"> •Agranulocytosis (< white blood cells) |

Levamisole is Toxic

- Withdrawn from the Canadian (2003) and USA (1999) markets due to toxicity
- Results in a decrease of white blood cells that can lower immunity and increase opportunist infections
- Associated with inflammation of blood vessels that can cause severe damage to skin
- Identified as cocaine adulterant in 2003
- Appeared in U.S., Europe, and Latin America

Used to cut cocaine

- A metabolite (aminorex) of levamisole acts to prolonged the high associated with cocaine
- Has resulted in many reports of cocaine users suffering toxic side effects from levamisole
 - Skin reactions
 - Seizures
 - Low White Blood Cell Count (Granulocytopenia)

Levamisole Skin Toxicity



Acetaminophen Risks

Cases of severe liver damage have occurred in patients who:

- took more than the prescribed dose in a 24-hour period (i.e., 3 grams or 3,000 mg);
- took more than one acetaminophen-containing product at the same time; or
- drank alcohol while taking the product (risk of kidney disease also).

FDA recommended dose – 325 mg/tablet

Effects of Levamisole in combination ??????????



Global Child Drug Use

A range of verifiable toxicological test data have enabled INL to document the world's first detected instances of child drug use, ranging from infancy to 12 years of age, with many instances observed in children five to eight years old.



Drug Exposure



- **Active Use** – direct smoking
- **“Second-hand” Exposure** – inhalation of smoke in the environment
- **“Third-hand” Exposure** – residual drug contamination of surfaces



Home Surface, Air, and Hair Results Year 2

(ng per swab, cartridge, or pg/mg)

| Sample | MOR | COD | 6-AM | HC | HM |
|--------------|---------|---------|-------|-------|-------|
| Pillow | 485 | 478 | NA | 0 | 0 |
| Mattress | 387 | 375 | NA | 0 | 0 |
| Cradle | 237 | 193 | NA | 0 | 0 |
| Pillar | 162 | 165 | NA | 0 | 0 |
| Blanket | 176 | 162 | NA | 0 | 0 |
| Air, smoking | 562,974 | 402,671 | 0 | 0 | 0 |
| Hair, 35 F | 15,011 | 15,485 | 1,680 | 2,612 | 1,187 |
| Hair, 10 M | 3,768 | 1,847 | 810 | 51 | 81 |
| Hair, 5 M | 15,554 | 8,360 | 1,490 | 182 | 476 |

Afghan Children—Positive Opiate Hair Results (pg/mg)

| Home | Age | Sex | COD | MOR | 6-AM | HC | HM |
|------|---------|-----|-------|-------|-------|-----|-------|
| 1 | 12 y.o. | M | 43 | 358 | 1,369 | 0 | 0 |
| 1 | 10 y.o. | F | 93 | 669 | 1,764 | 0 | 0 |
| 2 | 14 mo | F | 122 | 534 | 1,388 | 0 | 0 |
| 4 | 5 y.o. | M | 0 | 45 | 181 | 0 | 0 |
| 6 | 5 y.o. | M | 0 | 57 | 0 | 0 | 0 |
| 6 | 6 y.o. | F | 0 | 45 | 0 | 0 | 0 |
| 6 | 10 y.o. | F | 0 | 61 | 0 | 0 | 0 |
| 7 | 12 y.o. | M | 0 | 56 | 157 | 0 | 0 |
| 11 | 6 y.o. | M | 0 | 69 | 214 | 668 | 1,745 |
| 11 | 5 y.o. | F | 0 | 52 | 148 | 0 | 0 |
| 13 | 8 y.o. | F | 118 | 45 | 0 | 0 | 0 |
| 15 | 9 mo | M | 0 | 48 | 0 | 0 | 0 |
| 22 | 10 y.o. | M | 2,422 | 3,190 | 0 | 68 | 0 |
| 22 | 8 y.o. | M | 6,477 | 8,907 | 0 | 137 | 328 |
| 24 | 10 y.o. | F | 4,652 | 8,350 | 5,607 | 183 | 569 |
| 25 | 11 y.o. | M | 2,403 | 3,802 | 1,989 | 0 | 0 |
| 27 | 3 y.o. | F | 43 | 58 | 0 | 0 | 0 |

Afghan Children Testing Positive for Drugs in Six Women and Children Drug Treatment Centers *(All results based on hair testing unless specifically noted)*



| Age | Sex | MOR | COD | 6-AM | HC | HM | Province |
|-----|-----|---------|--------|------|-----|-------|------------|
| 2 | M | 28* | | | | | Badakhshan |
| 3 | M | 596 | 259 | 81 | 0 | 0 | Farah |
| 3 | F | 8,484 | 3,922 | 0 | 224 | 566 | Badakhshan |
| 3 | M | 15,094 | 11,397 | 0 | 650 | 1,243 | Badakhshan |
| 4 | F | 18,222 | 3,277 | 0 | 0 | 0 | Kabul |
| 4 | F | 80,095 | 22,223 | 0 | 201 | 798 | Kabul |
| 4 | F | 243 | 0 | 153 | 0 | 0 | Herat |
| 4 | F | 286 | 793 | 0 | 151 | 0 | Balkh |
| 5 | F | 36,159 | 8,517 | 405 | 0 | 270 | Kabul |
| 5 | F | 9,047 | 1,504 | 0 | 0 | 0 | Kabul |
| 5 | M | 720 | 475 | 0 | 0 | 0 | Balkh |
| 5 | M | 129 | 206 | 0 | 0 | 0 | Badakhshan |
| 6 | F | 34,425 | 6,161 | 0 | 0 | 221 | Kabul |
| 6 | M | 99,504 | 56,548 | 576 | 599 | 1,581 | Kabul |
| 6 | M | 68,577 | 21,088 | 109 | 294 | 849 | Kabul |
| 6 | F | 103,334 | 90,477 | 622 | 747 | 2,532 | Kabul |
| 6 | F | 427 | 0 | 0 | 0 | 0 | Herat |
| 6 | F | 3,139 | 2,610 | 0 | 135 | 0 | Balkh |
| 6 | F | 114 | 192 | 0 | 0 | 0 | Nangarhar |
| 7 | M | 30,603 | 5,955 | 0 | 0 | 184 | Kabul |
| 7 | M | 51* | 11* | | | | Kabul |
| 7 | M | 235 | 0 | 0 | 0 | 0 | Kabul |
| 7 | F | 55,883 | 12,329 | 0 | 106 | 498 | Kabul |
| 7 | F | 519 | 112 | 0 | 0 | 0 | Herat |
| 7 | M | 358 | 491 | 0 | 0 | 0 | Balkh |
| 7 | F | 0 | 0 | 130 | 0 | 0 | Balkh |
| 7 | M | 179 | 339 | 0 | 0 | 0 | Badakhshan |
| 7 | M | 427 | 444 | 0 | 0 | 0 | Badakhshan |
| 8 | F | 361 | 0 | 0 | 0 | 0 | Herat |
| 9 | M | 857 | 519 | 0 | 0 | 0 | Balkh |
| 10 | F | 100,628 | NA | 811 | 791 | 1,996 | Kabul |
| 10 | M | 396 | 0 | 0 | 0 | 0 | Kabul |
| 11 | M | 2,721 | 2,636 | 359 | 329 | 0 | Farah |
| 12 | M | 2,086 | 1,155 | 0 | 0 | 0 | Balkh |
| 12 | M | 3,098 | 2,247 | 609 | 138 | 0 | Farah |

*Results based on oral (saliva) testing

MO = Morphine; CO = Codeine; 6-AM = 6-Acetylmorphine ; HC = Hydrocodone; HM =Hydromorphone

Programs and Innovative Projects

Specialized Training for Special Populations: Children Who Use Drugs

Project: Child Treatment Protocols and Training

- Child addiction not limited to Afghanistan.
- Opiate drug use among children and adolescents in India, Pakistan, and Bangladesh.
- Crack cocaine use by street children in the Southern Cone and South Africa

- INL has initiated a global child drug use program which assesses the issue of child drug use on a city-by-city basis, delivering a specialized treatment curriculum based on the children's protocols developed by international organizations (UN, WHO, OAS, Colombo Plan) and international universities, and conducts routine follow-up mentoring with organizations providing treatment and social support services to children.



Crack Use by Street Children

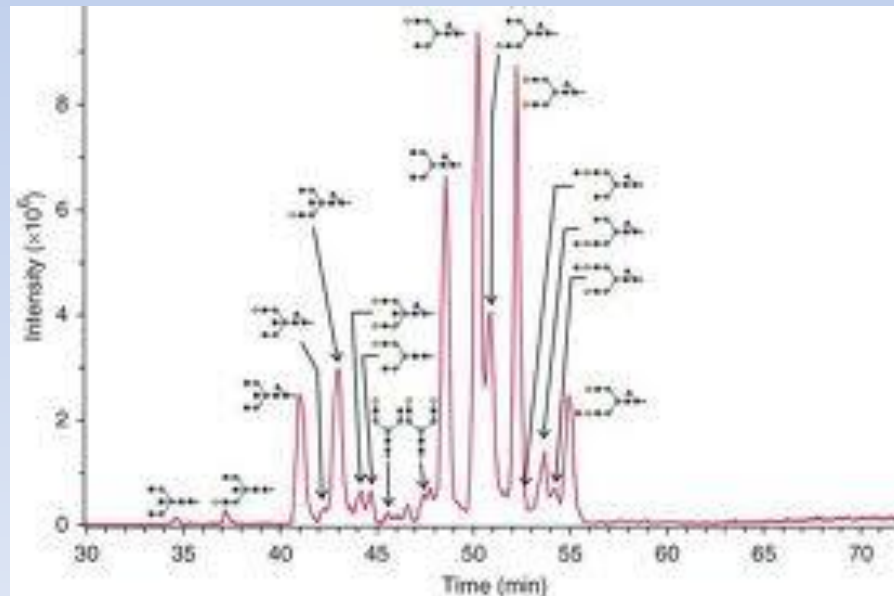
- Abundant Supply: 25 cents – \$1 per dose
- Crack cheaper than solvents & glues, with more pleasurable mind altering effects
- Exposure to drugs, toxic adulterants, and chemical impurities can result in problems with learning, behavior, and development

Crack and Children (Con't.)

- Adulterants and chemical impurities can cause greater harm and at lower doses in the child and adolescent brain
- Children's metabolisms and developing immune systems mean their bodies are less able to get rid of contaminants or reduce the toxicity of selected adulterants
- Adulterants that suppress the immune system are an especially ominous threat to these children

COCAINE ADULTERANT DETECTION

- GC/MS older technology, screen, confirm
- LC/MS/MS faster, more compounds

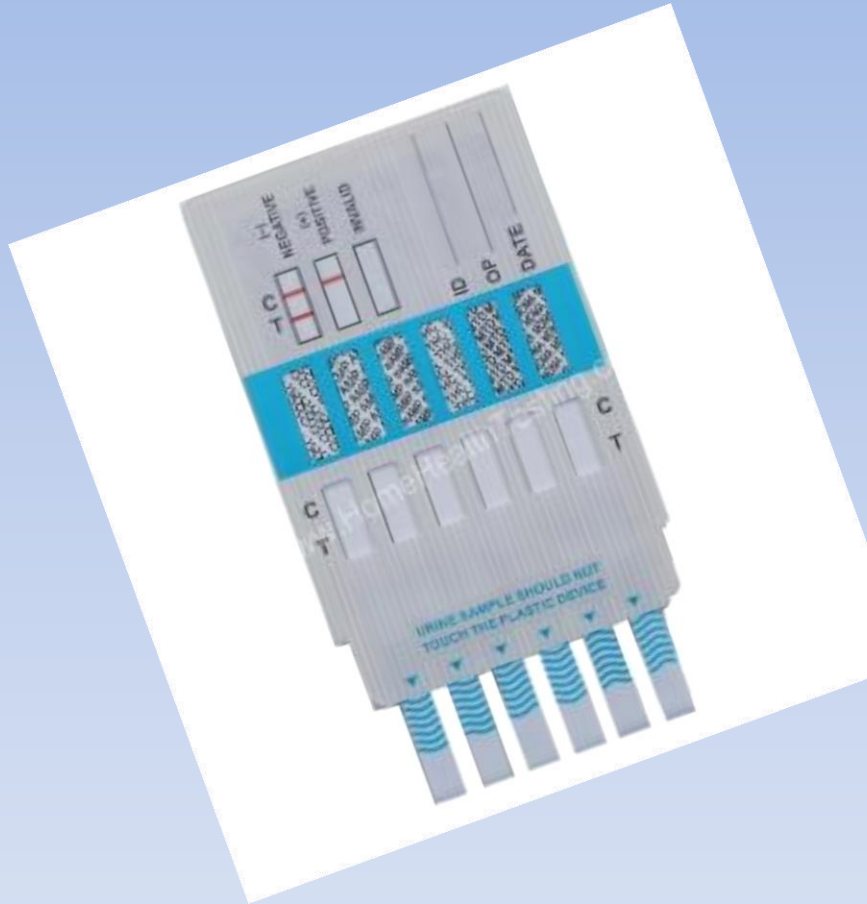


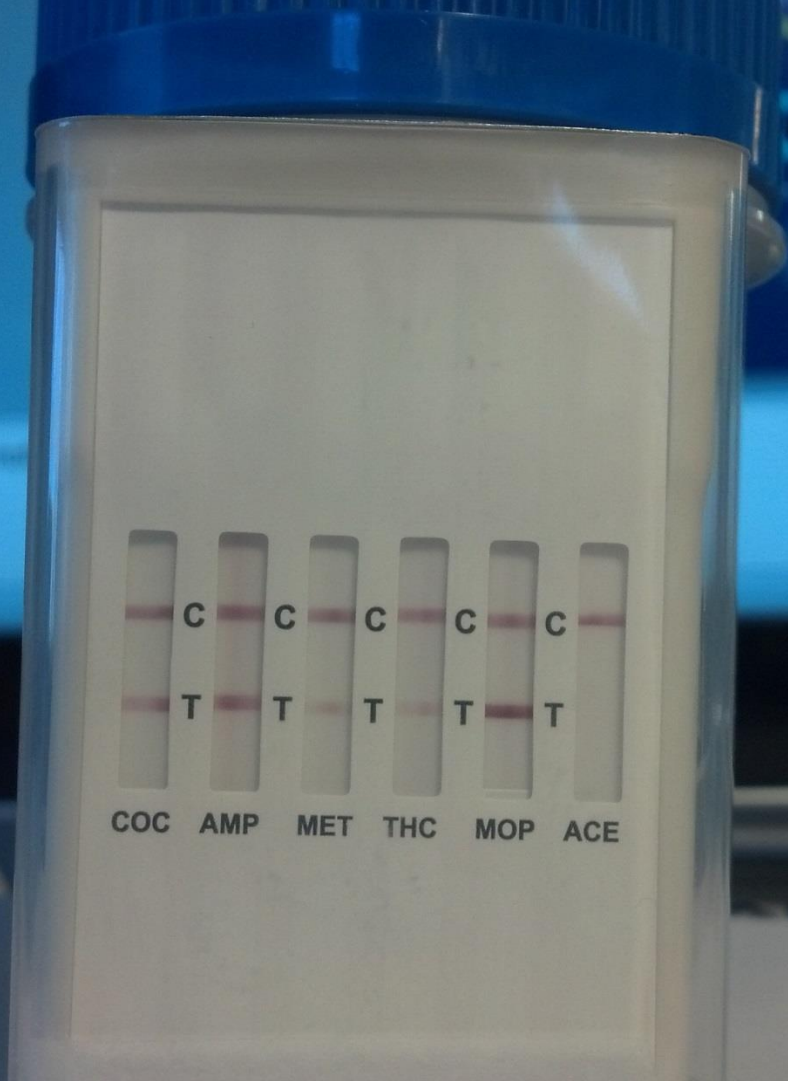
COCAINE ADULTERANT FIELD DETECTION

- Levamisole, Phenacetin, and Aminopyrine
- Detected in Hair, Saliva and Urine - Lab based
- Detected in Drugs – Lab based
- No field test available (drug or biological)



Quick Test for Adulterants





COC AMP MET THC MOP ACE

C C C C C C

T T T T T T

Drug Use Around the World Today

- On a global level, drug use is stable.

Fig. 1. Global trends in drug use, 2006-2012

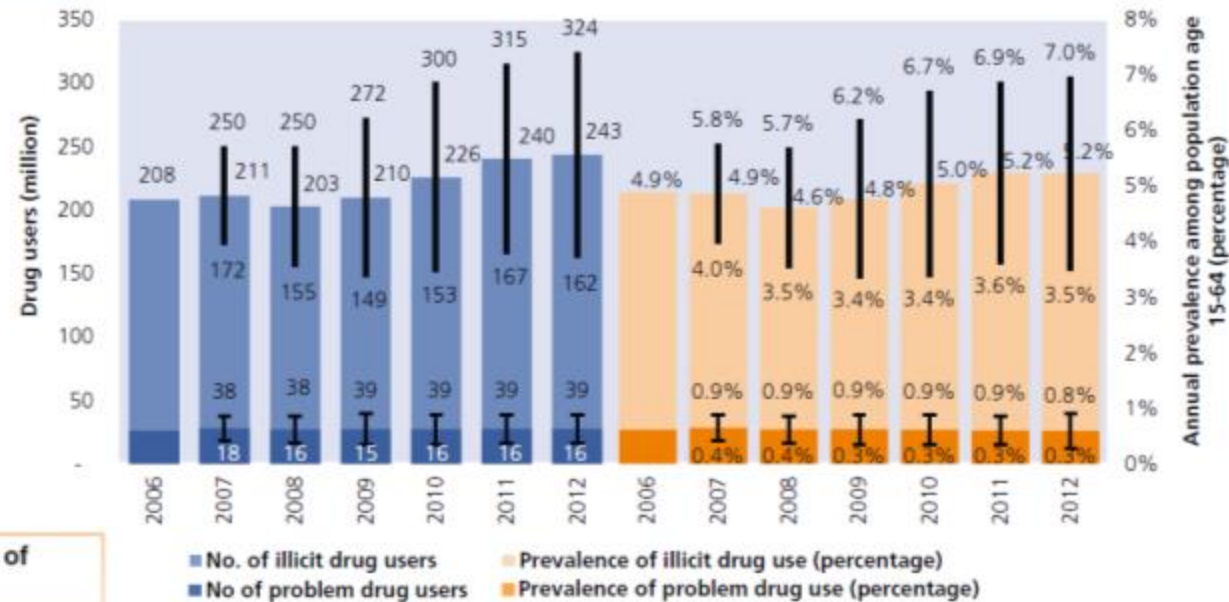
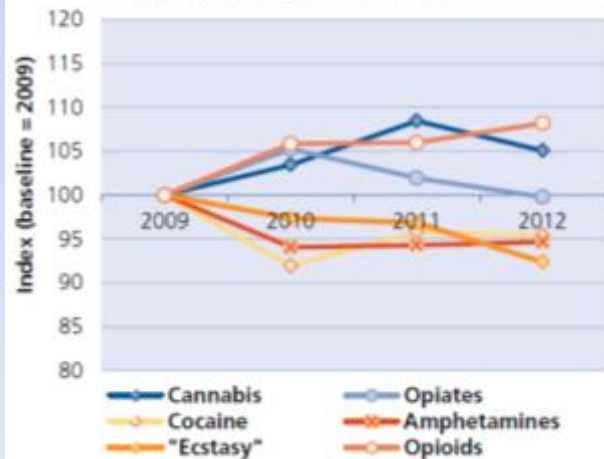


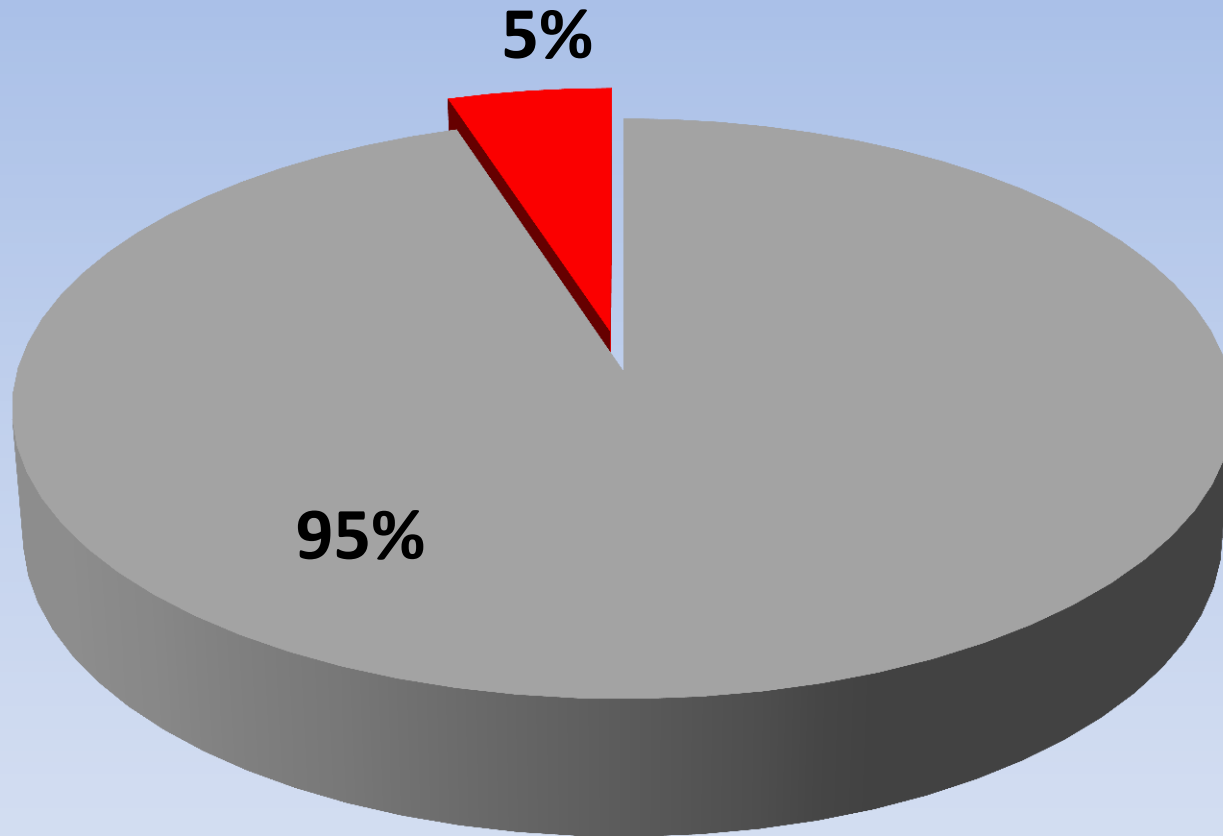
Fig. 2. Trends in the prevalence of use of different drugs, 2009-2012



- 243 million people (5.2% of world population) used an illicit drug at least once in the previous year.
- 27 million people (0.5% of world population) are problem drug users

Source: UNODC World Drug Report (2014).

Global Drug Use



| | |
|-------|-------|
| No | Yes |
| ■ Não | ■ Sim |
| No | Si |