Drug Testing
is the
Technology of Recovery

National Council of State Boards of Nursing
June 14, 2017
EDUCATIONAL OBJECTIVES

DRUG TESTING: THE TECHNOLOGY OF RECOVERY

• History of Drug Testing in the Last 25 years
• Workplace vs PHM Drug Tests: Importance of Policy
• Specimen Validity Testing, Cutoffs
• Modern Technologies and Sample of Drug Testing
• Urine, Hair, Nails, Blood Spot, Saliva, Breath
• New Alcohol Testing Rule of Three
• Case Studies and Question and Answers
NEVER TESTED POSITIVE FOR DRUGS
PROFESSIONAL HEALTH MONITORING (PHM) DRUG TESTING

- Test with the right technologies
- On the right samples
- With the right laboratory
HEALTH PROFESSIONAL EASY ACCESS TO A WIDE VARIETY OF DRUGS?
NEW EPIDEMIC OF DRUG ABUSE

- Pain Clinics=Opioids
- Medical Marijuana
- Internet Pharmacies
- Synthetic THC
- Designer Drugs
DRUG FREE FEDERAL WORKPLACE

1981

1984

1986
“CRISIS IN DRUG TESTING:
RESULTS OF A CENTER FOR DISEASE CONTROL BLIND STUDY”

Hugh J. Hansen, PhD; Samuel P. Caudill, PhD; D. Joe Boone, PhD
Journal of the American Medical Association, 1985, 253:282

<table>
<thead>
<tr>
<th>DRUGS</th>
<th>FALSE NEGATIVE</th>
<th>FALSE POSITIVE</th>
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<tbody>
<tr>
<td>BARBITURATES</td>
<td>11 - 94 %</td>
<td>0 - 6 %</td>
</tr>
<tr>
<td>AMPHETAMINES</td>
<td>19 - 100 %</td>
<td>0 - 37 %</td>
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<tr>
<td>METHADONE</td>
<td>0 - 33 %</td>
<td>0 - 66 %</td>
</tr>
<tr>
<td>COCAINE</td>
<td>0 - 100 %</td>
<td>0 - 6 %</td>
</tr>
<tr>
<td>CODEINE</td>
<td>0 - 100 %</td>
<td>0 - 7 %</td>
</tr>
<tr>
<td>MORPHINE</td>
<td>5 - 100 %</td>
<td>0 - 10 %</td>
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## "NIDA 5" DRUG PANEL 1990

<table>
<thead>
<tr>
<th>DRUG</th>
<th>CUT-OFFS</th>
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<tr>
<td></td>
<td>Screen</td>
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<tr>
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<td>300</td>
</tr>
<tr>
<td>MARIJUANA</td>
<td>100</td>
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<tr>
<td>PCP</td>
<td>25</td>
</tr>
<tr>
<td>OPIATES (morphine, codeine)</td>
<td>2000</td>
</tr>
<tr>
<td>DRUG</td>
<td>CUTOFFS (ng/ml)</td>
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<tr>
<td>----------------------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td>SCREEN</td>
</tr>
<tr>
<td>MARIJUANA</td>
<td>50</td>
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<tr>
<td>COCAINE</td>
<td>150</td>
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<tr>
<td>PCP</td>
<td>25</td>
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<tr>
<td>CODEINE/MORPHINE</td>
<td>2000</td>
</tr>
<tr>
<td>6-ACETYL MORPHINE</td>
<td>10</td>
</tr>
<tr>
<td>AMPHETAMINES</td>
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<tr>
<td>MDE</td>
<td>500</td>
</tr>
<tr>
<td>MDMA</td>
<td>500</td>
</tr>
<tr>
<td>MDA</td>
<td>500</td>
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</table>
PHM DRUG TESTING 2017

- **Amphetamines**
  - Amphetamine
  - Methamphetamine
  - MDA
  - MDMA
  - MDEA

- **Cocaine**

- **Marijuana**

- **PCP**

- **Opiates**
  - Morphine
  - Codeine
  - 6-MAM
  - Hydrocodone
  - Hydromorphone
  - Oxymorphone
  - Oxycodone
  - Buprenorphine
  - Methadone
  - Meperidine
  - Propoxyphene
  - Tramadol
  - Fentanyl

- **Benzodiazepines**
  - Oxazepam
  - Nordiazepam
  - Temazepam
  - Lorazepam
  - Flurazepam
  - Nitrazepam
  - Triazolam
  - Alprazolam
  - Flunitrazepam
  - Midazolam
  - Clonazepam

- **Barbiturates**
  - Butabital
  - Amobarb
  - Pentobarbital
  - Secobarb
  - Phenobarbital

- **ETG**
- **ETOH**
- **PEth**

Zolpidem
Soma
Meprobamate
Ketamine
DRUG TESTING POLICY

• Written Policy outlining the Drug Testing Program
• Supervisory Training
• Drugs Tested vs Zero Tolerance
• Third Party Administrator
• Participant Education on Program Entry
• Confidential Medical Review of Positives
• Consequences of a Positive Test
• Annual Review and Update
DRUG TESTING POLICY

- Random Testing Mechanics
- Consequences of Non-Compliance
- Reasonable Suspicion Testing
- Post Incident Testing
- Periodic Testing
- Adulteration, Substitution and Dilution
- Dilute Negatives
DRUG METABOLISM

Saliva/Blood/Breath

Urine

Hair/Nails

EtG Cutoff
ng/ml

Lab B 500

Lab A 100

Hours

Days

Months

Lab B	Lab A
500	100
HOW DRUG TESTS ARE COMPROMISED

• Adulteration of Urine with Products

• Substitution with a Clean Urine

• Dilution with Water
ANTI-DRUG TESTING PRODUCTS
ADULTERATION

• Intentional Addition of Substances
• Mask Drug Use or Compromise Testing
• Initial Screening Test Immunoassay
• pH Shift e.g. Vinegar, Bleach, Drano
• Chemistry Shift e.g. Detergent, Methanol
• High Tech Adulterants
• Detected by Specimen Validity Tests
SUBSTITUTION

- Substitution of Donor with Drug-Free Specimen
- Biological Substitution
- Non-Biological Substitution
- Detected Specimen Validity Testing
DILUTION

• Most Common Form of Tampering
• Pre-Testing high volume of fluids
• Use of Products e.g. Absolute Detox
• Dilution of Collected Urine
• Detected by Specimen Validity Testing
• Consult with your TPA and MRO
• Establish a Policy
SPECIMEN VALIDITY TESTING

- Creatinine
- Specific Gravity
- pH
- Temperature
- Nitrates
- Glutaraldehyde
- Pyridine
- Chromium
CREATININE

- Product of muscle metabolism
- Produced at a constant rate daily
- Unique to Biological Specimens
- Super Hydration Reduces Creatinine
- Rare Medical Disorders Low Creatinine
- < 20 mg/dl are Dilute
CREATININE

- Dilute Positives are Positive
- Establish a Policy for Dilute Negatives
- Low Creatinines 10 Times Higher in Randoms
- Normal urine creatinine: 2005 study “Urinary Creatinine Concentrations in the U.S. Population” determine was 130 mg/dl
- Less than 1% below 20 mg/dl
- Less than 1% greater than 400 mg/dl
SPECIFIC GRAVITY

• Density of Liquid vs Water

• Normal Urine Values 1.0020-1.0200

• Combined with Creatinine provides **Dilute** or **Substituted** Reports
pH

• Acidity or Alkalinity of Specimen

• Normal Range 4.5-8.9

• New cutoffs raised from <3 to <4

• pH <4.0 or >11.0 reported as Adulterated
DILUTE or SUBSTITUTED URINE CRITERIA

• Samples with a Creatinine >2.0 and <20 mg/dl
  and
• a Specific Gravity >1.0010 and <1.0030 are reported as Dilute

• Samples with a Creatinine <2.0
  and
• a < 1.0010 or > or equal to 1.0200 considered to be Substituted

• 65 FR 79526, Dec. 19, 2000, as amended at 69 FR 64867, Nov.9, 2004
DILUTE, ADULTERATED OR SUBSTITUED URINE POLICY

• Follow Established DOT/DHHS and Your Policy

• Positive Dilutes, treated as Positives

• MRO Interviews Donor and Physician for Medical Explanation Dilute Negatives, Adulterated or Substituted Urines

• MRO directs recollection under direct observation if creatinine is equal to or $>2$mg/dl, but less than or equal to 5 mg/dl

• 68 FR 31626, May 28, 2003; 69 FR 64867, Nov.9, 2004; 73 FR 35974, June 25, 2008
An invalid drug test is the outcome of a drug test for a urine sample that contains an endogenous substance at abnormal concentrations, has abnormal physical characteristics, contains an unknown interfering substance, or an unknown contaminant that prevents the laboratory from obtaining a suitable valid result on the test.

- Creatinine <2.0 mg/dl, Specific Gravity >1.0010 or <1.0200 or Temperature
- Unidentified Substance in Confirmation
- Screening Test Technically Failed
- Sample Physically Not Acceptable
- MRO Questions Donor
• mg/ml Thousand $10^{-3}$
• ug/ml Million $10^{-6}$
• ng/ml Billion $10^{-9}$
• pg/ml Trillion $10^{-12}$
• fg/ml Quadrillion $10^{-15}$
## DIFFERENT DRUG TESTING CUTOFFS

<table>
<thead>
<tr>
<th></th>
<th><strong>EtG ng/ml</strong></th>
<th></th>
<th><strong>Fentanyl</strong> ng/ml</th>
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<tbody>
<tr>
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<td>Confirmation</td>
<td>Screening</td>
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<tr>
<td><strong>Lab A</strong></td>
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<td>100</td>
<td>0.2</td>
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<td><strong>Lab B</strong></td>
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<td>125</td>
<td>10</td>
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<tr>
<td>Sample ID</td>
<td>Lab A Low cutoff</td>
<td>Lab B Higher cutoff</td>
<td>Reason</td>
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<td>2</td>
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</tr>
<tr>
<td>3</td>
<td>EtG+</td>
<td>EtG+</td>
<td>&gt;500</td>
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<tr>
<td>4</td>
<td>Tramadol+</td>
<td>Neg</td>
<td>Cutoff</td>
</tr>
<tr>
<td>5</td>
<td>Morphine+</td>
<td>Morphine Only</td>
<td>Cutoff</td>
</tr>
<tr>
<td></td>
<td>Oxazepam+</td>
<td></td>
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<tr>
<td>6</td>
<td>Fentanyl+</td>
<td>Pos</td>
<td>&gt;10</td>
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<td>7</td>
<td>Fentanyl+</td>
<td>Neg</td>
<td>Cutoff</td>
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<td>8</td>
<td>Fentanyl+</td>
<td>Neg</td>
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<tr>
<td>9</td>
<td>Fentanyl+</td>
<td>Neg</td>
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# LAB EXPANSION & CONTRACTION

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<td>10</td>
<td>238</td>
<td>95</td>
<td>35</td>
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<tr>
<td>PHM</td>
<td>0</td>
<td>10</td>
<td>500</td>
<td>&gt;1000</td>
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INSTANT URINE DRUG TEST FRAUD

- > 70 KITS ON MARKET
- Not all have similar cutoffs
- Manufacturing
- Performance
- Validity tests
- >False negatives
HAIR DRUG TESTING

- 7-10 days after drug use hair is positive
- 90 day window of detection
- 10-17 drugs routinely tested
- Direct observed collection
HAIR COLOR AFFECTS TESTING

<table>
<thead>
<tr>
<th>Hair Color</th>
<th>Concentration (pg/mg hair)</th>
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<tbody>
<tr>
<td>Black</td>
<td>1134.0</td>
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<tr>
<td>Brown</td>
<td>250.8</td>
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<tr>
<td>Blonde</td>
<td>119.6</td>
</tr>
<tr>
<td>Red</td>
<td>66.6</td>
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</table>
- 7-10 days after drug use nails are positive
- 180 day window of detection
- No melanin in nails vs hair
- 10-14 drugs routinely tested
- Direct observed collection
**Incorporation of Alcohol & SOA**

Biomarkers become trapped in the keratin fibers.

As the nail grows in thickness and length, biomarkers from alcohol and other substances of abuse build up in the nail at the germinal matrix and along the nail bed.

**Biomarker:** a measurable substance whose presence is indicative of ingestion or exposure to substances of abuse (SOA).
ALCOHOL KEY TO THE DRUG PROBLEM

Among U.S. adults over the age of 18:

- 15.3 million have an alcohol use disorder only
- 2.3 million have both an alcohol use disorder and a drug use disorder
- 1.9 million have a drug use disorder only

IF YOU WANT TO CONTROL THE DRUG PROBLEM
CONTROL THE ALCOHOL PROBLEM FIRST
DRINKING BEHAVIORS AFFECTS DETECTION

Area Under the Blood Alcohol Curve for 3 Different Drinking Behaviors

- 1x 6 Drinks AUC = 10.6 mg*h/g
- 2x 3 Drinks AUC = 5.10 mg*h/g
- 6x 1 Drinks AUC = 1.38 mg*h/g
ALCOHOL TESTING

Standard Technology
- Breathalyzer – Hours/Drink
- Saliva - Hours/Drink
- Blood – Hours/Drink
- Urine – Hours/Drink

Technology of Recovery Tests
1) Urine Ethyl Glucuronide (EtG) - 3 Days after drinking
2) Phosphatidylethanol (Peth) - 3 weeks binge drinking
3) Hair/Nails EtG – 3 months binge drinking
EtG in URINE

Ethyl glucuronide, metabolite of Alcohol

• In standard use since 2000
• Cutoff for recovery 100 ng/ml
• Not fermentation affected
• Abstinence monitoring
• Detection 2-3 days 1 drink
EtG in HAIR
Society of Hair Testing Suggestions

Consistent with Abstinence
Increasing Risk
Consistent with Chronic Excessive Drinking

EtG Hair (pg/mg)
FIVE TIMES MORE THC IN NAILS

MEAN CONCENTRATIONS OF THCA IN HAIR AND FINGERNAIL
22 MATCHED PAIRS

Mean Concentration (pg/mg)

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<thead>
<tr>
<th></th>
<th>Hair</th>
<th>Nail</th>
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<tbody>
<tr>
<td>Concentration</td>
<td>854</td>
<td>4662</td>
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PHOSPHATIDYLETHANOL (PEth)
Formation of PEth and Its Elimination During Extensive Drinking Over 5 Days

Alcohol Testing Rule of 3

• 3 Hours Breath
• 3 Days ETG urine
• 3 Weeks PEth
• 3 Months ETG hair/nails
PHM Monitoring Program

- Intelligent Science Based Population
- Target Drug(s) of Choice
- Vary Matrix eg Hair, Nails, Urine, Blood Spots
- Vary Panels, small to large, cost savings
- Insure SVT are Included and Policy in Place
- Reach Out with Questions to your TPA and Lab
- Monitor and Treat the Patient, not the Drug Test
Question and Answer Time
CASE STUDY #1

• 2 Social Drinkers, 10th Day Drug Tested
• Male ~ 2 drinks/day, Female 1 drink/day

URINE ETG= POSITIVE
Hair and Nail ETG= NEGATIVE
Peth= NEGATIVE
CASE STUDY #2

Male heavy social drinker 195 lbs
• 5-night cruise-2 binges per day
• Stopped drinking, tested Day 1

URINE ETG= POSITIVE
Hair and Nail ETG= NEGATIVE
Peth= POSITIVE 181 ng/ml
Male heavy social drinker 195 lbs.  
- 5-night cruise - 2 binges per day  
- Stopped drinking, tested Day 10

URINE ETG = NEGATIVE  
Hair and Nail ETG = NEGATIVE  
Peth = POSITIVE 93 ng/ml
ETG and AUDIT SCORES

- Alcohol Use Disorders Test
- 10 item screening test
- World Health Organization
- Clinician Administered version
- Self-Report Version
- **Score of >8** indicated harmful alcohol use
- [https://pubs.niaaa.nih.gov/publications/Audit.pdf](https://pubs.niaaa.nih.gov/publications/Audit.pdf)
CASE STUDY 168 POUND MALE

Nail EtG = ND
Hair EtG = ND
Audit = 4

LAST 90 DAYS = 59 Drinks
LAST 30 DAYS = 18 Drinks
LAST 7 DAYS = 13 Drinks

90-DAY TLFB REPORT
CASE STUDY 183 POUND MALE

Nail EtG = 258
Hair EtG = 89
Audit = 24

LAST 90 DAYS = 459 Drinks
LAST 30 DAYS = 123 Drinks
LAST 7 DAYS = 36 Drinks

90-DAY TLFB REPORT
CASE STUDY #3

CASE STUDY 132 POUND FEMALE

Nail EtG = 192
Hair EtG = ND
Audit = 16
Cosmetic Treatment

LAST 90 DAYS = 234 Drinks
LAST 30 DAYS = 84 Drinks
LAST 7 DAYS = 5 Drinks

NUMBER OF REPORTED DRINKS

90-DAY TLFB REPORT
CASE STUDY #6

• 38 YEAR OLD FEMALE NURSE RECOVERING ALCOHOLIC
• NALTREXONE COMPLIANCE QUESTIONED
• URINE NALTREXONE NEGATIVE
• HAIR NALTREXONE NEGATIVE

• FINGER NAIL POSITIVE FOR NALTREXONE
CASE STUDY #7

• 48 year old male air force nurse reported to State Board

• Urine test was negative

• Hair test ordered

• Body was clean shaven, not sufficient nails for testing

• Toe nail tested and positive for cocaine
CASE STUDY #8

• Nurse with history of opioid abuse
• Positive for hair and fingernails oxycodone

• Toe nail test was negative
CASE STUDY #9

• Contentious Legal Custody Case

• Husband alcoholic Sober-Link 0.025

• Court ordered PETH= 37 ng/ml

• Lawyers argued two 8oz of cough syrup

• Court ordered additional PEth, 42 ng/ml

• Nurse obtained custody of her children
DRUG TESTING IS THE TECHNOLOGY of RECOVERY

- 5 years of Random Drug Testing > 70% recovery
- Daily call 800 Random Drug Test Line
- If selected must report for testing
- Panels and samples may vary
- Entire industry of specialized labs and TPAs
CONCLUSIONS

• Know your laboratory, technology and cutoffs

• “What are the screening and confirmation technologies and cutoffs, how long have you been in business?”

• Vary testing panels, urine, saliva, hair, blood

• Custom design testing programs individual addiction
“Treat the patient, not the drug test”
Presenter Contact Information and Coupon for Free Consultation

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