

2012
Web Seminar Series

**BIOLOGICAL MEASURES
AND SPECIMEN HANDLING**

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Presentation Outline


- Common Biological Measures/Testing
 - Urinary Drug Screen (UDS)
 - Drug Hair Analysis
 - Electrocardiogram
 - Blood Chemistry and Hematology
- Specimen collecting, labeling, storing, and shipping recommendations
- Universal Precautions

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CTN Biological Measures Overview

– Common CTN measures include

- Urine screening--drug use or pregnancy
- Drug Hair Analysis
- Breathalyzer testing for alcohol use
- Electrocardiogram [ECG]
- Blood chemistry and hematology
- Vital signs



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Biological Measures Usage in the CTN

- Inclusion or exclusion criteria
- Outcome measures
- Contingency management
- Used in both behavioral, pharmacological or combination trials

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1. Urine Testing

- Urinary Drug Testing
- Urine Adulterant Testing




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Urinary Drug Screen (UDS)

CTN Standard UDS Card


- BZO = Benzodiazepine
- AMP = Amphetamine
- THC = Marijuana
- MET = Methamphetamine
- OPI = Opiates (2000 ng)
- COC = Cocaine
- MDMA = Ecstasy
- OXY = Oxycodone
- MTD = Methadone
- BAR = Barbiturate



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Standard UDS Dipcard


- Lead Teams, NIDA CCTN, and TEAM Task Force chose 10 key drugs of abuse
- Standardization of UDS dipcard allows for consistent data collection across CTN studies
- Standard UDS eCRF used for NIDA CCTN trials
- While the dipcard is standard, drugs of interest analyzed for a study are decided by the protocol development team



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Urine adulteration


- Adulterant testing is done to check the integrity of a urine specimen
- Visual determination of oxidants, creatinine, nitrite, glutaraldehyde, pH, specific gravity and chromate values in urine to assess the integrity of urine samples prior to UDS



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Cheating on a UDS Test

- Tampering
- Water-loading
- Switching drugs
- Taking vitamins- Niacin (aka vitamin B3) is known to aid metabolism
- Swapping urine samples



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Adulterant Test

The Adulterant test analyzes urine for the following:

1. Creatinine
2. Nitrite
3. pH
4. Specific Gravity
5. Glutaraldehyde
6. Bleach
7. Pyridinium Chlorochromate

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Adulterant Test

- Each substance can have three levels with the urine:
- Normal
- Abnormal (Low)
- Abnormal (High)
- Levels are indicated by color on cylinder

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Adulterant Test

- Read each test at the specified time after dipping
 - Immediate
 - pH
 - 30 seconds
 - Bleach, and Pyridinium Chlorochromate
 - 45 seconds
 - Creatinine
 - Nitrite
 - Specific Gravity
 - Glutaraldehyde
- Practice until comfortable with timing and process
- Use laminated card with color code for ease in analysis

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Common Urine Adulterants

- Dilution is the most common form of adulteration
- Specific gravity and creatinine determine if urine has been diluted and if the participant is “flushing or water-loading”
 - Normal specific gravity of urine is 1.003–1.035 g·cm⁻³
 - Low specific gravity and low creatinine indicate that a sample has been diluted
 - Common diluents
 - Bleach, vinegar, Visine, sodium bicarbonate, Drano, soft drinks or hydrogen peroxide
- Aldehyde (glutaraldehyde).
 - Commercially available adulterants include the following
 - UrinAid, Stealth, Stealth 51, and INSTANT CLEAN ADD-IT-IVE
 - Disrupts the enzyme used in immunoassays like urinalysis
 - Not found naturally in urine.

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Common Urine Adulterants (cont'd)

- Chemical oxidants
 - Nitrates
 - Whizzies, Klear
 - Work by oxidizing the major cannabinoid receptor metabolite THC COOH²
- pH
 - The pH of urine can vary between 4.6 and 8, with neutral (7) being norm
 - Adulterants can affect the pH balance of urine
- Pyridinium Chlorochromate (PCC)
 - Sold under the brand name “Urine Luck”
 - Normal urine should not contain oxidants or PCC

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Proper UDS Procedure


- After confirming:
 - acceptable urine temperature
 - not adulterated
- Proceed with UDS using QuickTox custom dipcard
- Remove bottom plastic cover
- Dip card in urine
 - at least 10 seconds to the blue arrows on each strip
- Replace the bottom plastic cover
- Lay the device on a flat surface
 - at least 5 minutes
- Read UDS strip after 5 minutes after dipping in urine

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Common UDS Issues

- The chain of events of the UDS step is not completed appropriately
- The dipcard is not dipped in urine up to the arrows

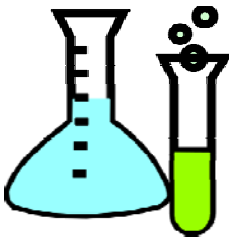


- UDS results are read too long after the test is performed
- UDS supplies not kept at recommended temperature of 15°-30°C.
- UDS pouch is opened prematurely

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2. Other Types of Testing

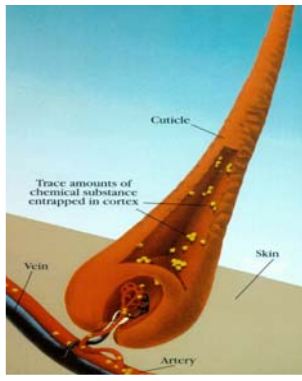
- Drug hair analysis
- ECGs



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Drug Hair Analysis

- Hair growth is fed by the bloodstream, the ingestion of drugs of abuse is revealed by analyzing a small sample of hair
- Hair testing methods measure drug molecules embedded inside the hair shaft, eliminating external contamination as a source of a positive test result
- Hair testing results cannot be significantly altered with shampoos or other external chemicals



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Drug Hair Analysis vs. UDS

- Drug Hair Analysis
 - 3 month detection window
 - Determines history of abuse (segment analysis)
 - Inability to tamper with the test
 - Body hair and head hair can be collected
 - Hair Color and treatments may impact results
 - Disadvantage for people with limited hair
- UDS
 - 1-3 day detection window
 - Determines use but not history of abuse
 - Economical cost

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Drug Hair Analysis


- Head hair collection is the preferred collection method
- Grasp a small lock of hair visibly equal to **½ inch wide by 1-2 strands deep** when held flat across your finger



- Cut as close to the scalp as possible
- Select area that is not detectable after sample collection

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Drug hair analysis challenges



No sir, I don't think we'll have any difficulty gathering a sufficient sample.

Clearly, I have no hair to spare!

Body hair: An alternative to head hair

- Body hair is thin and less than 1/2 inch long
- Collection from multiple spots
- Hair can be combined from the legs, chest, underarms and arms
- Body hair can never be combined with head hair
 - Different detection windows

Body Hair Collection Process

Fold Paper in half creating a "paper trough"

Place under body collection site

Shave as much hair as possible from body hair locations

Transfer hair from the "paper trough" to provided foil and place in the SAC

How much is needed and why?

- Screening of each drug class requires 8 mg of hair
- 5 drug class test requires 12 mg of hair for each test
 - Opiates
 - THC
 - Amphetamines
 - PCP
 - Cocaine
- 68 mg of hair required for a complete hair analysis test

Sufficient Amount of Hair

Psychomedics Requires Less Hair



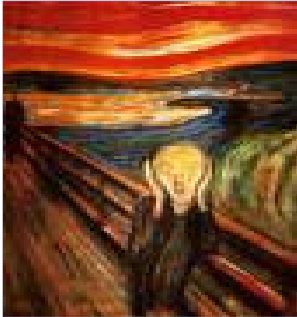
Amount of hair required by Psychomedics. (Diameter of lead inside a pencil)

Amount of hair required by other hair testing labs. (Diameter of pencil or soda straw)

Quantity not Sufficient (QNS)

QNS Samples too small to complete testing procedures

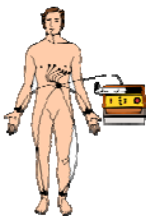
- Hair analysis cost is significantly more than cost of a UDS
- Processing fee for samples that are not able to be analyzed



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What is an electrocardiogram (ECG)?

ECG is an acronym for electrocardiogram



- Electro - refers to electricity
- Cardio - refers to the heart
- Gram - refers to a recording

Therefore, an electrocardiogram is a recording of the heart's electrical activity

Note: Sometimes ECGs are also called EKGs

What Happens During an ECG?

The illustration below shows the standard setup

Normal heart rhythm recording (ECG)

Nurse monitoring EKG procedure

Heart rhythm recorded on a machine to produce an electrocardiogram (ECG)

Electrodes attached to chest, upper arms and legs

Electrodes connected to EKG machine

What can an ECG tell you?

An ECG shows:

- How fast your heart is beating
- Whether the rhythm of your heartbeat is regular or irregular
- The strength and timing of electrical signals as they pass through each part of your heart

A 12-Lead ECG with only 10 'leads'?

The term lead in "a 12-lead ECG" refers to the number of "views" of the heart's electrical activity not the number of electrodes

The typical 12-lead ECG setup can show 12 different views but only has 10 wires or electrodes

Preparation for Conducting an ECG

1. A warm room (no shivering participants, please)
2. An examination table where participant can comfortably and safely lie down for 10-15 minutes
3. Paper "gowns" to minimize participant exposure and discomfort
4. A flat surface for your ECG machine (not on the exam table)
5. An electrical outlet for your ECG machine
6. Alcohol wipes to cleanse skin where electrodes will be placed
7. A shaving tool (razor) to remove excess hair from sites where electrodes do not make good contact with the skin

Applying the Electrodes

- (V1) 4th intercostal space, right of sternum
- (V2) 4th intercostal space, left of sternum
- (V3) midway between V2 and V4
- (V4) 5th intercostal space, in the midclavicular line(V6)
- (V5) same level as V4, at anterior axillary line (between V4 and V6)

Completing the ECG


- 1) After turning on the ECG unit, press the "12-Lead Key" and check the screen to verify that you are in the 12-lead mode
- 2) Enter all participant information as prompted, remembering that NO participant names should be entered at any time. If the name field requires that you enter an alpha numeric character in order to proceed, you may enter the letter "z" or "x" as a place holder instead of a name

When Leads are Properly Placed

Most ECG strips will look more or less like this

Normal sinus rhythm


A normal sinus rhythm (NSR), shown in the strip below, is the common, everyday rhythm



Reversed Leads or Misplaced Electrodes

Electrode/lead placement is very important. If red and white lead cables are not placed properly (i.e. the white one is where the red one should go and vice versa), you might get an ECG that looks like the strip below

In this ECG strip, you can still make out a normal sinus rhythm (just like the strip above) but all of the waves are upside-down



3. Blood Chemistry and Hematology



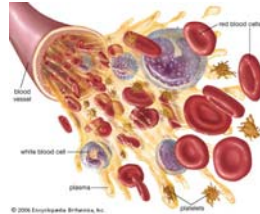
Specimen Collection and Handling

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Hematology Importance in Clinical Trials

- Human blood is made up of about 45% cellular components primarily Red Blood Cells (RBC), White Blood Cells (WBC) and Platelets, and 55% fluid

Components	Function
Red Blood Cells (RBC)	Carry oxygen
White Blood Cells (WBC)	Fight infection
Platelets	Clotting
Plasma	Transport nutrients, hormones and proteins



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General Rules for Specimen Collection

- Check protocol to ensure the correct study day and measure to be performed
- Make sure it is the correct participant
- Use the correct specimen collection tube for the measure
- Make sure the collection site allows for quick, efficient collection and easy clean up
- Follow and document all observation procedures required by the protocol

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General Rules (cont'd)

- Use only clean, single-use collection containers appropriate for the protocol
- Label any containers immediately after collection
 - Take extra care to assure label is legible
- Follow all protocol procedures for storage and shipping
- Completely and accurately document collection of biological measures

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General Shipping Guidelines

Shipping

- The shipper is responsible and held accountable for packaging and shipping compliance
- A courier has the right to refuse to accept any package that is not correctly packed, labeled, marked or documented

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Long-Term or Short-Term Sample Storage

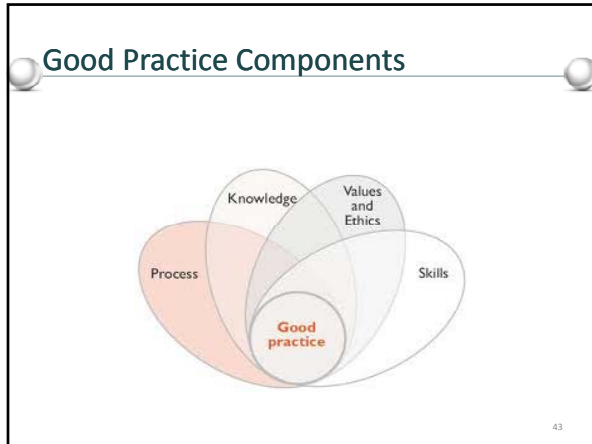
- Stored specimens should be labeled, in the appropriate container, and organized in accordance with node and protocol requirements
- Refrigerator/freezer should only be used for specimen/laboratory storage (i.e., staff is not using the refrigerator to store food)
- Refrigerator/freezer used for storing clinical specimens must be regularly monitored to ensure that it is working properly

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Institution Practices

- Follow your institution's guidelines for safe handling of biological specimens and disposal of biohazard materials
- If your institution does not have guidelines on safe handling of biological specimens and disposal of biohazard materials, then assess your needs and create a general guideline that covers your level of need

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Good Practice (cont'd)

Biological measures **must** be collected in accordance with protocol requirements and good clinical practices


Failure to do so threatens the research integrity

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Universal Precautions

- Ways that you can reduce risk of exposure to any potentially infectious material
- Ways in which you can respond to any exposure that does occur



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Means of Occupational Transmission

- An accidental puncture by a sharp object exposed to body fluids. "Sharps" include objects such as:


- Open cuts or skin abrasions coming in contact with contaminated blood or body fluids



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Occupational Safety and Health Administration (OSHA)

- OSHA mandates annual blood-borne pathogen training for employees who may come in contact with blood
- OSHA standard is intended to protect employees from exposure to HIV, HBV, HCV and other blood-borne pathogens
- Some CTN protocols require collection of blood; may be conducted by nurse, phlebotomist, or research assistant

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Who is at risk for occupational transmission?

- Anyone who comes in contact with blood is at risk for exposure to HIV and hepatitis
- Those at risk would be any workers that may face potential exposure to human blood or other body fluids that may carry disease
- HBV and HCV present the greatest risk to health care workers

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What are potentially infectious materials?

- Blood, blood products, and blood components
- Human body fluids such as semen, vaginal secretions, cerebrospinal fluids
- Any body fluid visibly contaminated with blood
- All body fluids in situations where it is difficult or impossible to distinguish between body fluids




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Is urine a potentially infectious material?

- Urine may be contaminated with small amounts of blood that are not visible to the naked eye


TREAT URINE AS A POTENTIALLY INFECTIOUS MATERIAL!!!



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Definition of Exposure

- Skin, eye, mucous membrane, or primary contact with any potentially infectious material



- Exposure to any amount of potentially infectious material is an exposure

Treat all exposures as though the material is infectious

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Prevention of Exposure

- Engineering controls
- Work practice controls
- Use of personal protective equipment (PPE)
- Hand washing

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Workplace Practice Controls

When working in areas where exposure is reasonably likely, DO NOT:

- Eat
- Drink
- Smoke
- Apply cosmetics or lip balm
- Handle contact lenses
- No food or drink should be kept in refrigerators, freezers, shelves, cabinets, or on counter tops where blood or potentially infectious materials are present

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Universal Precautions

Personal Protective Equipment (PPE)

Types of PPE

- Single use gloves
 - made of latex, nitril, rubber, or other water impervious materials
 - The most important PPE for specimen handling and disposal is wearing single use gloves
 - **Always wear gloves!**
- Lab coat/gown
- Eye Protection
- Face shield
- Use the most appropriate type of PPE to reduce exposure

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Proper Removal of Disposable Gloves



Tips on removing gloves after use

- Peel gloves off hands from the wrist down to the fingers, turning the gloves inside out – this prevents contact with any contaminated surface of glove
- Be careful not to touch equipment or work surfaces with contaminated gloves
- Remember gloves can tear or rip, so be careful when handling sharps

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Preventing Exposures

How do you prevent exposures?

- Proper handling of sharps
- Proper disposal of biohazardous waste
- Good housekeeping practices
- Hand washing

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Universal Precautions-Biohazard Waste

What should be treated as biohazard waste?

- Used gloves & collection cups
- Used needles (sharps)
- Towels used to clean specimen handling surface area
- Anything that has been exposed to a biological specimen

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Universal Precautions – Biohazard Waste (cont'd)

- There are three types of biohazard waste-- each type needs to be handled separately
 - Sharps (i.e., needles, glass)
 - Soft disposables (i.e., gloves, plastic, paper)
 - Lab bench, equipment & instrumentation
 - Follow your institution's and state's regulations for proper disposal of biohazard waste
- How do you clean up body fluid spills?
 - Follow your institution's procedures

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General Rules for Clean Up

- Restrict area access until complete
- Wear appropriate PPE
- Use disposable towels or mats
- Clean with disinfectant solution
 - 10:1 Water to bleach
- Dispose of all waste appropriately
- **How do you respond to an exposure?**
 - Follow your institution's procedures!

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Responding to Skin Exposure

- Clean and flush exposure site
- Provide all necessary first aid
- Notify supervisor
- Document incident

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Rules for Responding to Eye Exposure

- Flush eyes with water or normal saline while eyes are open
- Notify supervisor
- Document incident

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Responding to Mouth Exposure

- Spit out any contamination
- Rinse mouth several times
- Notify supervisor
- Document incident

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General Shipping Guidelines

Shipping

- Fill out all information on the laboratory requisition/sample log and send separate requisition/sample log with each shipment
- Keep a copy of requisition/sample log and courier waybill for your records
- If shipping around weekend/holiday, contact laboratory staff to ensure courier waybill and lab staff are properly prepared to receive shipment

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Biological Measures and Specimen Handling

- Additional Resources
 - Your node’s protocol specific training
 - Your institution’s procedures on universal precautions
 - CDC – Guideline for infection control in health care personnel, 1998
 - OSHA – Occupational exposure to blood borne pathogens, 1996
 - DOT - 49 CFR part 171 –178

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Questions

- Various types of testing modalities
- Universal precautions



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