

# ELABORATIONS

News and Issues for Washington's Clinical Laboratories

Volume XIII Issue 1

January 2008

## Patient Safety: Lab Pre-Analytic Errors - Part 1

by Linda Parisi, DOH/LQA

Quality systems are the heart of management in the laboratory setting. The quality system requires that the entire laboratory testing process is monitored and evaluated. This includes the pre-analytic, analytic, and post-analytic phases. Studies show that a large percentage of laboratory errors occur in the pre-analytic and post-analytic phases. There are much fewer errors in the analytic (testing) phase.

The following article is the first in a series of articles that discuss the pre-analytic phase of laboratory testing.

The pre-analytic phase includes the collection, handling, and processing of laboratory specimens. Pre-analytic errors introduced into a specimen before and during collection, transport, processing, or storage can alter patient results.

Proper handling of specimens begins with the initiation of a laboratory request. It includes patient identification, patient preparation, phlebotomy equipment selection, and "order of draw." The competent phlebotomist must have the technical skills to collect the blood specimen and the understanding of numerous variables, complications, and procedural errors that affect the integrity of the specimen.

**Physiologic variables that influence specimen composition:** The basal state refers to the condition of the body in the morning when a patient is at rest and fasting. Collection of blood when the patient is at the basal state minimizes the effects of diet, exercise, and other controllable factors on test results. The factors below influence the basal state. Some are controllable, others are not.

**Age:** Values for numerous blood components, such as Red Blood Cell Counts (RBCs) and White Blood Cell counts (WBCs), may vary considerably depending upon the age of a patient

**Altitude:** Decreased oxygen content at higher altitudes can cause increases in RBC production to compensate for lower levels of oxygen.

**Dehydration** causes hemoconcentration and can falsely increase some blood components such as RBCs, enzymes, iron, calcium, and sodium.

**Diet** significantly alters blood composition. Examples include:

- Glucose levels increase dramatically with the ingestion of sugar-laden foods but return to normal within two hours if the patient has normal carbohydrate metabolism.

continued on page 2

### Practice Guidelines

The following practice guidelines have been developed by the Clinical Laboratory Advisory Council. They can be accessed at the following website:  
[www.doh.wa.gov/lqa.htm](http://www.doh.wa.gov/lqa.htm)

Anemia	Lipid Screening
ANA	PAP Smear
Bioterrorism Event Mgmt	Point-of-Care Testing
Bleeding Disorders	PSA
Chlamydia	Rash Illness
Diabetes	Red Cell Transfusion
Group A Strep Pharyngitis	Renal Disease
Group B Streptococcus	STD
Hepatitis	Thyroid
HIV	Tuberculosis
Infectious Diarrhea	Urinalysis
Intestinal Parasites	Wellness

### Inside This Issue

- 2 Lab Pre-Analytic Errors - Part 1, cont'd
- 3 What is a Secondary Shipping Container?
- 3 2008 PHL Training Course Calendar/Website
- 4 12th Annual Conference/Calendar of Events

# Lab Pre-Analytic Errors, continued from page 1

- **Lipemia:** Lipid levels increase with the ingestion of fatty foods (fast food items, butter, and cheese). This is called lipemia. Lipemia can be present for 1 to 10 hours or more; therefore, some tests must be performed on patients who have been fasting for 12 hours or more.
- **Occult blood:** Some laboratory tests require the elimination of certain foods such as meat and certain vegetables for several days before a specimen is collected.
- **Fluids:** Excessive fluid intake can decrease hemoglobin (Hgb) levels and alter electrolyte balance. Consumption of caffeine can affect cortisol levels. Recent alcohol consumption can affect levels.

**Diurnal Variation:** Many blood constituents exhibit diurnal (daily) variations throughout the day. For example: WBC, eosinophil counts, and iron levels are lower in the morning; cortisol, insulin, potassium, and testosterone are highest in the morning; cortisol and iron levels may differ by 50% or more between 8:00 a.m. and 4:00 p.m.

**Drug Therapy:** Many drugs alter physiologic functions. This is the desired effect for most patients, but in some patients, this may result in unwanted physiologic effects. Thiazide diuretics often cause increased calcium and decreased potassium. Chemotherapy drugs can decrease WBCs and platelets. Numerous drugs are toxic to the liver

and cause increased liver enzymes. Steroids and diuretics can cause pancreatitis resulting in an increase in amylase and lipase values. Some drugs may interfere with the performance of a laboratory test resulting in false increases or decreases. It is up to the physician to recognize or eliminate the drug interferences, but it is helpful if the phlebotomist notes any observations on the requisition.

**Exercise:** The duration and intensity of the exercise, and the physical condition of the patient may affect some laboratory tests. For example, lactic acid, creatinine, protein, and certain enzymes will be elevated with exercise.

**Fever** affects the levels of some hormones. Hypoglycemia caused by fever increases insulin followed by glucagon levels. Cortisol can be increased by fever.

**Gender:** A patient's gender has an affect on numerous blood components such as RBCs, Hgb, and Hematocrit (Hct).

**Jaundice or icterus** is caused by an increase in bilirubin. The abnormal yellow-brown color may interfere in the color reaction of a number of chemistry tests including chemical reagent strip analysis on urine.

**Pregnancy** can cause physiologic changes in many body systems. The results for a number of laboratory tests must be compared to normal ranges established for the pregnant population.

**Smoking:** Nicotine affects a number of blood components, but the effects vary depending on the number of cigarettes smoked. Cortisol levels and WBC counts can be increased. Chronic smoking can lead to decreased pulmonary function and increased Hgb levels.

**Stress:** Emotional stress has been shown to cause short-lived increases in WBC counts, decreases in serum iron, and increases in adrenal hormone values.

**Temperature and Humidity:** Acute heat exposure causes interstitial fluid to move into the blood vessels and decrease the glomerular filtration rate. Excessive sweating without fluid replacement causes hemoconcentration.

The next articles in this series will address phlebotomy site selection variables that influence specimens, procedural errors that affect specimen quality, and errors associated with specimen handling.

*ELABORATIONS* is a free monthly publication of the Washington State Department of Health (DOH) Public Health Laboratories (PHL) and Office of Laboratory Quality Assurance (LQA).

Secretary, DOH: Mary Selecky  
Health Officer: Maxine Hayes, MD, MPH  
Director, PHL: Romesh Gautam, PhD  
Program Manager, LQA: Susan Walker  
Editor: Leonard Kargacin (206) 418-5416  
Circulation: Leonard Kargacin (206) 418-5416

Comments, letters to the editor, information for publication, and requests for subscription can be directed to:

*ELABORATIONS*  
Washington State Public Health Labs  
1610 NE 150th Street  
Shoreline, WA 98155

e-mail address: [leonard.kargacin@doh.wa.gov](mailto:leonard.kargacin@doh.wa.gov)

NOTE: Letters to the editor may be published unless specified otherwise by the author.

**Website addresses:**

**DOH home page:** <http://www.doh.wa.gov>  
**LQA home page:** <http://www.doh.wa.gov/lqa.htm>  
**PHL home page:**  
<http://www.doh.wa.gov/EHSPHL/PHL/default.htm>

# Tips for Shipping Infectious Substances: What is a Secondary Container?

by Paul Marbourg and Shelley Lankford, DOH/PHL

What is a Secondary Container? It is the middle packaging of a certified triple-pack shipping system. The secondary container is designed to provide additional containment capability in the event that the package is crushed or damaged during shipment. The secondary container may hold one or more primary containers depending on the design of the shipping system. If you plan to ship several specimens inside the secondary packaging, the primary containers must be physically separated from each other with padding or a separator grid to prevent breakage.

Inside the secondary container is where the absorbent material is placed. The absorbent material must have sufficient capacity to be able to absorb the *entire* liquid contents of all primary containers placed within the secondary packaging. A polymeric material engineered to absorb large quantities of liquid should be used for this purpose. Paper towels are *not* sufficiently absorbent for this function.

The secondary container may be made of any material that can be sealed so that it is leak-proof for liquids or sift-proof for solids. In a shipping system, either the primary receptacles or the secondary packaging must be capable of withstanding, without leakage, a pressure differential of 95 kPa in the range of -40°C to 55°C if you plan to transport the package by air. If you are unsure by what means the package will be transported to its destination, assume the worst and make sure it meets the pressure and temperature requirements for air transport. Most commercially certified triple-pack shipping systems already meet this requirement.

The secondary container can exist in many forms. It may be a rigid container with internal partitions to separate the primaries from each other. Alternatively, it could possibly consist of a *system* of a leakproof polybag marked with a biohazard label placed inside a Tyvek© (or equivalent) outer envelope.

The secondary container *must* have a biohazard label on the outside. This is the only place the biohazard labels should be placed when shipping Category B infectious substances. The secondary container should have the lab forms, patient forms or requisition form attached to its exterior. Place the form inside a ziploc bag to protect it from moisture, particularly when using chemical cold packs or dry ice inside the certified shipping system.

If you follow these few rules regarding secondary containers, you will be compliant with the latest shipping regulations. Look for the concluding article on Rigid Outer Packaging (the final component of a certified triple packaging system) in the next edition of Elaborations.

## 2008 PHL Training Course Calendar

The 2008 PHL Training Course Calendar is available at the following website: <http://www.doh.wa.gov/EHSPHL/PHL/Training/train.htm>. Information that you can find on this website includes:

- Training Course Calendar
- Registration Information
- Course Registration Forms
- Continuing Education Units Information
- PHL Training Program Personnel listing and contact information

## Helpful Websites:

### Medical Test Site Licensing Program

<http://www.doh.wa.gov/lqa.htm>

### Test Categorization

<http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfCLIA/search.cfm>

### CLIA Regulations

<http://www.cms.hhs.gov/clia/>

### WISHA/OSHA Safety Information

<http://www.lni.wa.gov/Safety/default.asp>

### PHL Training Program

<http://www.doh.wa.gov/EHSPHL/PHL/Training/train.htm>

## Calendar of Events

### PHL Training Classes:

(<http://www.doh.wa.gov/ehsphl/phl/training/train.htm>)

#### Basic Intestinal Parasites (2-Day Class)

February 13-14 Shoreline

#### 2008 ASCLS-WA Spring Meeting

April 24-26 Lynnwood

#### Northwest Medical Laboratory Symposium

October 15-18 Portland

#### 15th Annual Clinical Laboratory Conference

November 2008 Seattle

Contact information for the events listed above can be found on page 2. The Calendar of Events is a list of upcoming conferences, deadlines, and other dates of interest to the clinical laboratory community. If you have events that you would like to have included, please mail them to ELABORATIONS at the address on page 2. Information must be received at least one month before the scheduled event. The editor reserves the right to make final decisions on inclusion.