

# CRITICAL LINK



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Secretary

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Health and Mental Hygiene

The Laboratories Administration—Maryland's State Public Health Laboratory

## Long chain 3-hydroxyacyl-CoA dehydrogenase deficiency (LCHADD)

### A rare genetic disorder detected early in newborn period with Tandem Mass Spectrometry

Newborn screening is the process of testing newborn babies for treatable genetic, endocrinologic, metabolic, and hematologic disease.<sup>1</sup> The Maryland Department of Health and Mental Hygiene (DHMH) Newborn Screening Division screens for over 50 hereditary and genetic metabolic disorders. Over 30 of these are screened using tandem mass spectrometry.

Tandem mass spectrometry in the area of newborn screening utilizes blood spots dried on filter paper. A few drops of blood are obtained from the baby's

heel between 24 to 48 hours of birth and applied to a special filter paper. The specimen is dried and then sent to a Newborn Screening Laboratory for analysis. A 3 mm dried blood spot is punched from each patient specimen. The dried blood spot is combined with extraction solution to release the amino acid and acylcarnitine analytes. The free analytes are derivatized by adding butanol-HCL which allows for greater analyte stability. The derivatized analytes are reconstituted with methanol to create a mobile phase, and that is injected into the Mass spectrometer for analysis (Fig 1).

acylcarnitines are present and their quantities (Fig. 2).

Infants with rare inherited metabolic disorders have either too much or not enough amino acids or acylcarnitines. They can also have unusual types of amino acids and acylcarnitines in their blood.<sup>2</sup>

One of the rare disorders that can be detected using tandem mass spectrometry is long chain 3-hydroxyacyl-CoA dehydrogenase deficiency (LCHADD).

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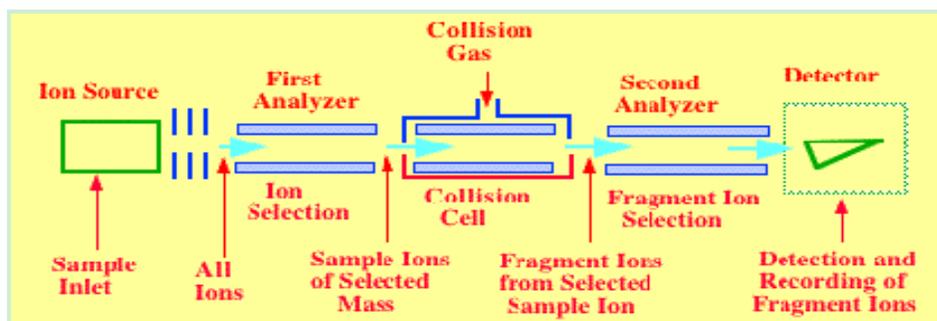


Figure 1: Diagram of sample acquisition by tandem mass spectrometry  
Source: Library 4 Science<sup>3</sup>

As each specimen is processed in the mass spectrometer, it separates and measures each analyte according to mass/charge ratio. The mass spectrometer measures which amino acids and

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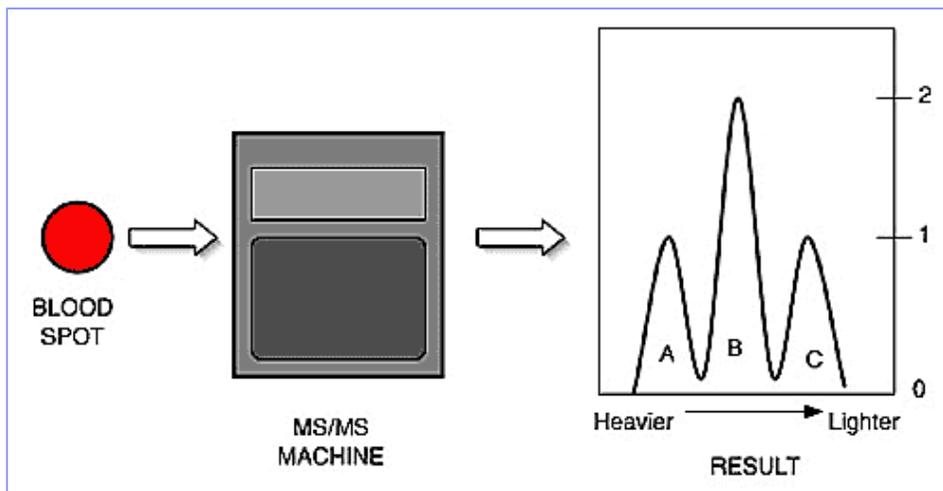


Figure 2: Diagram of tandem mass spectrometer newborn screening results  
Source: Star-G<sup>2</sup>

(Continued from page 1)

### *Long chain 3-hydroxyacyl-CoA dehydrogenase deficiency*

Children affected with LCHADD have problems converting fat, both stored and consumed, into usable energy for their bodies (Fig. 3). The first description of LCHADD was around 1990. Studies based on Finnish population indicate that 1 in 62,000 pregnancies is affected by this disorder.<sup>4</sup> In the United States, the incidence is probably much lower.

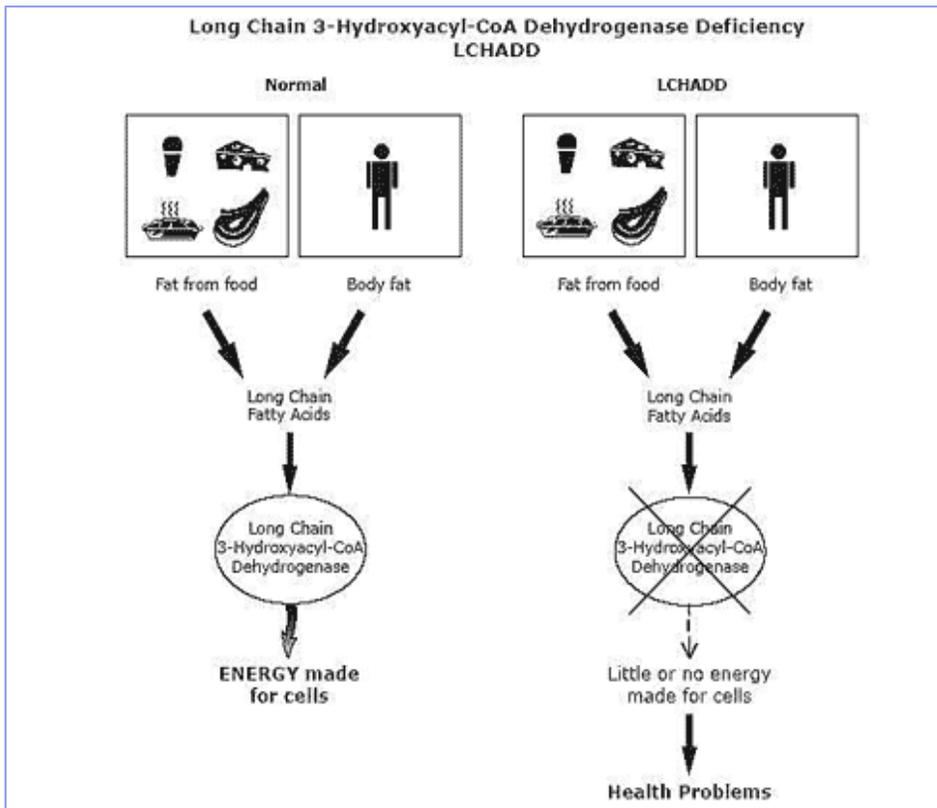
## Signs and Symptoms

The symptoms of LCHADD in infancy include feeding difficulties, lack of energy (lethargy), low blood sugar (hypoglycemia), weak muscle tone (hypotonia), liver problems, and abnormalities in the light-sensitive tissue at the back of the eye (retina).<sup>5</sup> As they grow into late childhood and eventually adulthood, the symptoms also may include muscle pain, breakdown of muscle tissue, and a loss of sensation in their arms and legs (peripheral neuropathy). The symptoms of LCHADD can be triggered or worsened by fasting and illness where the body is not receiving enough alternative sources of energy such as carbohydrates or protein.

## Genetics

LCHADD is an autosomal recessive disease that affects males and females equally. In patients with LCHADD, the *HADHA* gene mutates. For a child to be affected by LCHADD, the child must carry two mutated copies of the *HADHA* gene, one from the mother and one from the father (Fig. 4). The parents of the LCHADD affected child are usually carriers for the disorder. This means that both parents are not affected by the disorder, but each carries one copy of the mutated gene. Because both parents are carriers for LCHADD, the risk of having an affected child is 25% with each pregnancy. The *HADHA* gene codes for the mitochondrial trifunctional protein (MTP) that consists of four  $\alpha$ -subunits, which in turn produces the three enzymes necessary to metabolize long chain fatty acids from food and body fat.<sup>5</sup> More specifically, there is a mutation in the active portion of the MTP enzyme complex. The most common mutation seen in LCHADD patients is a genomic mutation that is caused by a guanine base being changed to a cytosine at nucleotide 1528.<sup>6</sup> Since the body is not able to produce the enzymes needed to break down long chain fatty acids, they start to build up in the body. The accumulation of the long chain fatty acids are responsible for the symptoms of LCHADD. The body

(Continued on page 3)



**Figure 3: Diagram of LCHADD**  
Source: STAR-G<sup>7</sup>

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### **Long chain 3-hydroxyacyl-CoA dehydrogenase deficiency**

becomes tired (lethargy) because there is no fat to use for energy. To compensate, it will start to break down the muscles (weak muscle tone) and take all available glucose from the blood (hypoglycemia.) This contributes to the problem. The excess build up of long chain fatty acids also causes liver, heart, muscle, and retina problems.

### **Health Effects on the Mother**

Pregnant women who are heterozygous LCHADD carriers (one normal copy of the *HADHA* gene and one mutated copy) may have health risks. They are at a higher risk of developing complications during pregnancy if the fetus is affected with LCHADD. Some of the complica-

tions can be acute fatty liver of pregnancy (AFLP) and hemolysis, elevated liver enzymes, low platelets (HELLP) syndrome. The symptoms of AFLP and HELLP are: persistent nausea and vomiting, pain in the stomach or upper-right abdomen, general malaise, jaundice, and headache. Without prompt treatment, AFLP can lead to coma, organ failure and even death of mother and baby.<sup>8,9</sup> The risks of HELLP on the mother are liver damage, kidney failure, bleeding problems, stroke, and even death, and the risk to the fetus is placental abruption.<sup>8,9</sup> Although the symptoms of both these diseases are similar, the risk of maternal death is higher with AFLP. Both these diseases present themselves in late pregnancy, usually in the 3rd trimester, and occur in less than 1% of women.<sup>8,9</sup> AFLP and HELLP syndrome require the baby to be delivered as soon as possible, even if the baby will be premature, to prevent serious complications.<sup>8,9</sup>

## **Treatment**

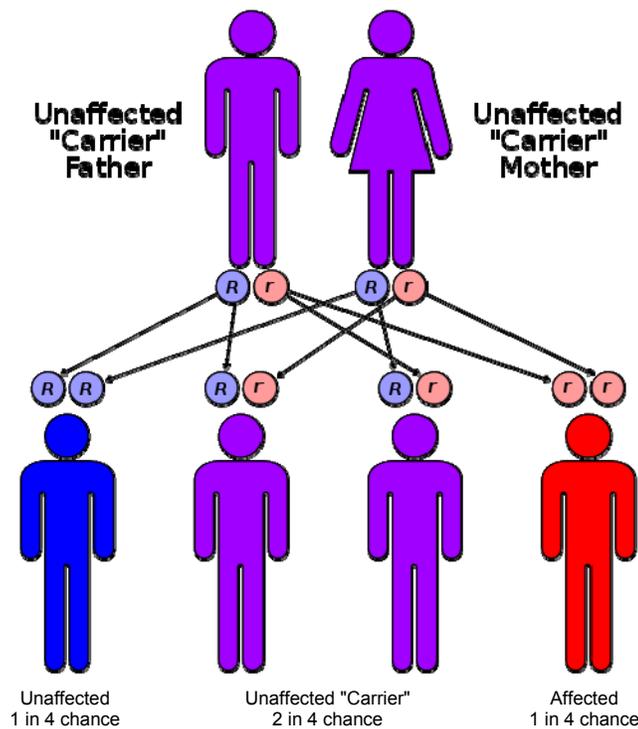
LCHADD patients can live normal healthy lives with normal growth and development if they have proper monitoring and treatment. The initial treatment for LCHADD is delivery of the baby, even if the child will be premature, to protect the mother and child. Long-term treatment is necessary throughout life and consists of a monitoring food intake and constant monitoring of metabolic needs. LCHADD patients require a specialized diet, and need to eat more frequently. The specialized diet consists of frequent, low fat, high carbohydrate, and high protein meals. Infants who are well should not go longer than 4 hours without eating, even if they must be woken up to be fed. Some healthy adults can last 12 hours without food.<sup>7</sup> LCHADD patients also use supplements that include medium chain triglyceride oil (MCT oil), L-carnitine, and docosahexanoic acid (DHA) to provide their bodies with additional energy sources. Long periods of exercise or exertion should be avoided by LCHADD patients to avoid the breakdown of muscles for the purpose of energy. If this is ignored, it can lead to kidney damage or death.<sup>7</sup> LCHADD patients should be constantly monitored for hypoglycemia to avoid learning problems, mental retardation, and vision, muscle, liver or heart problems.<sup>7</sup>

*This article written by Amy Stevens and Dr. Fizza Majid*

## **References**

- <sup>1</sup> Tarini, B.A. (2007) The current revolution in Newborn Screening: new technology, old controversies. Archives of Pediatric Medicine 161 (8):767-72 <http://ukpmc.ac.uk/abstract/MED/17679658/reload=0;jsessionid=-853657F00B770D48EA504F355395CC26.jvm4>
- <sup>2</sup> Star-G. (2009, June). Expanded Newborn Screening Using Tandem Mass Spectrometry. Retrieved from <http://www.newbornscreening.info/Parents/info.html>
- <sup>3</sup> <http://www.chromatography-online.org/index.html>

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**Long chain 3-hydroxyacyl-CoA dehydrogenase deficiency**

<sup>4</sup> Copeland, S., Tuerck, J., & Paradise, L. (n.d.). LONG-CHAIN HYDROXYACYL-CoA DEHYDROGENASE [Fact Sheet]. Retrieved from Oregon Health Authority website: <http://public.health.oregon.gov/LaboratoryServices/NewbornScreening/Documents/lchad.pdf>

<sup>5</sup> Genetics Home Reference. (2009). Long-chain 3-hydroxyacyl-CoA dehydrogenase deficiency. Retrieved April, 2011, from National Library of Medicine website: <http://ghr.nlm.nih.gov/condition/long-chain-3-hydroxyacyl-coa-dehydrogenase-deficiency>

<sup>6</sup> Sperk, A., Mueller, M., & Spiekerkoetter, U. (2010, July). Outcome in six patients with mitochondrial trifunctional protein disorders identified. <http://www.sciencedirect.com/science/article/pii/S1096719210002593>

<sup>7</sup> STAR-G. (2007, October). Fatty Acid Oxidation Disorders. Retrieved from <http://www.newbornscreening.info/Parents/fattyaciddisorders/LCHADD.html#1>

<sup>8</sup> March of Dimes. (2008). Pregnancy Complications. Retrieved from [http://www.marchofdimes.com/Pregnancy/complications\\_liver.html](http://www.marchofdimes.com/Pregnancy/complications_liver.html)

<sup>9</sup> Vorvick, L., & Storck, S. (2010). HELLP Syndrome. Retrieved from National Institute of Health website: <http://www.nlm.nih.gov/medlineplus/ency/article/000890.htm>

<sup>10</sup> Wikipedia. (n.d.). Long-chain 3-hydroxyacyl-coenzyme A dehydrogenase deficiency. Retrieved from [http://en.wikipedia.org/wiki/Long-chain\\_3-hydroxyacyl-coenzyme\\_A\\_dehydrogenase\\_deficiency](http://en.wikipedia.org/wiki/Long-chain_3-hydroxyacyl-coenzyme_A_dehydrogenase_deficiency)

Figure 4: LCHADD autosomal recessive inheritance  
Source: Wikipedia

# Laboratory Statistics

Reported by the  
Laboratories Administration  
covering results from the month of  
**March 2011**

## ENTERIC BACTERIOLOGY

GENUS	SEROVAR	SEX	AGE	#	JURISDICTION
CAMPYLOBACTER					
M				51	OUT OF STATE

### CAMPYLOBACTER JEJUNI

F	0	1	ALLEGANY
F	3	1	ALLEGANY
M	25	1	ALLEGANY
U	58	1	BALTIMORE
U	47	1	BALTIMORE
F	65	1	BALTIMORE
F	33	1	BALTIMORE
M	58	1	BALTIMORE
M	0	1	MONTGOMERY
F	38	1	OUT OF STATE
F	32	1	OUT OF STATE
M	48	1	OUT OF STATE

### CAMPYLOBACTER LARI

M	57	1	BALTIMORE
M	71	1	TALBOT

### CAMPYLOBACTER SPECIES PRESENT UNABLE TO SPECIATE ORGANISM ISOLATE SENT TO CDC FOR IDENTIFICATION.

M	39	1	OUT OF STATE
ESCHERICHIA COLI, SEROTYPE O157:H7			
M	3	1	ANNE ARUNDEL
M	3	1	BALTIMORE
F	3	2	BALTIMORE
F	1	1	BALTIMORE
M	53	1	OUT OF STATE

### SALMONELLA

F	51	1	BALTIMORE CITY
M	45	1	BALTIMORE CITY
F	1	1	CECIL
F	86	1	FREDERICK
F	59	3	FREDERICK

F	54	1	FREDERICK
F	29	1	FREDERICK
F	53	1	MONTGOMERY
F	0	1	MONTGOMERY
F	0	1	OUT OF STATE
F	25	1	OUT OF STATE
F	1	1	OUT OF STATE
M	63	1	OUT OF STATE
M	3	1	OUT OF STATE
M	89	1	WASHINGTON
SALMONELLA SER. 4,5,12:1-			
M	50	1	HARFORD
F	4	1	OUT OF STATE
SALMONELLA SER. ENTERITIDIS			
U	2	1	BALTIMORE
F	10	1	BALTIMORE
M	81	1	BALTIMORE
M	63	1	BALTIMORE
M	51	1	BALTIMORE
U	0	1	BALTIMORE CITY
F	0	2	BALTIMORE CITY
F	51	1	BALTIMORE CITY
F	31	1	BALTIMORE CITY
F	25	1	BALTIMORE CITY
F	16	2	BALTIMORE CITY
F	8	2	BALTIMORE CITY
F	3	1	BALTIMORE CITY
F	2	1	BALTIMORE CITY
F	0	1	BALTIMORE CITY
M	67	1	BALTIMORE CITY
M	58	2	BALTIMORE CITY
M	55	2	BALTIMORE CITY

M	53	1	BALTIMORE CITY
M	46	2	BALTIMORE CITY
M	27	1	BALTIMORE CITY
M	24	1	BALTIMORE CITY
M	16	1	BALTIMORE CITY
M	10	1	BALTIMORE CITY
M	2	1	BALTIMORE CITY
M	1	1	BALTIMORE CITY
M	0	1	BALTIMORE CITY
F	77	1	CARROLL
M	9	1	CARROLL
M	5	1	CARROLL
M	50	1	FREDERICK
F	59	2	HARFORD
M	72	2	HARFORD
F	0	1	MONTGOMERY
F	64	1	OUT OF STATE
F	51	1	OUT OF STATE
F	45	1	OUT OF STATE
F	41	1	OUT OF STATE
F	17	1	OUT OF STATE
F	1	1	OUT OF STATE
M	47	1	OUT OF STATE
M	32	1	OUT OF STATE
M	31	1	OUT OF STATE
M	22	1	OUT OF STATE
M	1	1	OUT OF STATE
U	0	1	PRINCE GEORGE'S
F	7	1	UNKNOWN
SALMONELLA SER. HEIDELBERG			
M	8	1	OUT OF STATE
M	5	1	OUT OF STATE
SALMONELLA SER. JAVA			
M	4	1	BALTIMORE CITY
SALMONELLA SER. JAVIANA			
F	91	1	ANNE ARUNDEL
U	21	1	MONTGOMERY
F	91	1	OUT OF STATE
F	63	1	OUT OF STATE
SALMONELLA SER. LONDON			
F	23	1	KENT
SALMONELLA SER. NEWPORT			
F	66	1	BALTIMORE
M	0	1	BALTIMORE
F	86	1	OUT OF STATE
F	10	1	OUT OF STATE
F	3	1	OUT OF STATE
M	53	1	OUT OF STATE
F	45	1	WICOMICO
SALMONELLA SER. ORANIENBURG			
F	26	1	BALTIMORE
F	34	1	OUT OF STATE
SALMONELLA SER. PANAMA			
F	2	2	MONTGOMERY
SALMONELLA SER. PARATYPHI A			
M	52	1	BALTIMORE
M	59	1	BALTIMORE CITY
F	30	9	OUT OF STATE
SALMONELLA SER. SAINTPAUL			
U	0	1	ANNE ARUNDEL
M	1	4	BALTIMORE CITY
SALMONELLA SER. TYPHI			
M	44	1	OUT OF STATE
SALMONELLA SER. TYPHIMURIUM			
F	0	1	BALTIMORE
F	41	1	BALTIMORE CITY
M	41	1	BALTIMORE CITY

M	46	1	CALVERT
F	39	1	MONTGOMERY
M	2	1	MONTGOMERY
F	19	1	OUT OF STATE
F	9	1	OUT OF STATE
F	3	1	OUT OF STATE
M	1	1	OUT OF STATE
U	13	1	PRINCE GEORGE'S
F	24	1	PRINCE GEORGE'S
F	66	1	TALBOT
F	6	1	WASHINGTON
SALMONELLA SPECIES PRESENT SENT TO CDC FOR SEROTYPING.			
U	0	1	OUT OF STATE
F	15	1	OUT OF STATE
SALMONELLA SPECIES PRESENT SENT TO CDC FOR SEROTYPING.			
F	64	1	HARFORD
SHIGELLA FLEXNERI II:3,4			
U	3	1	BALTIMORE CITY
SHIGELLA SONNEI			
F	27	3	BALTIMORE
F	3	1	BALTIMORE
F	5	1	OUT OF STATE
M	35	1	OUT OF STATE
M	28	1	OUT OF STATE
F	20	1	WASHINGTON
UNABLE TO IDENTIFY ORGANISM SENT TO CDC FOR FURTHER TESTING.			
F	0	1	BALTIMORE
VIBRIO ALGINOLYTICUS			
M	12	2	OUT OF STATE
VIBRIO FLUVIALIS			
M	66	1	BALTIMORE CITY
M	45	1	BALTIMORE CITY

**TOTAL 163**

### ISOLATES - REFERENCE

GENUS SPECIES		
SOURCE	#	JURISDICTION
STAPHYLOCOCCUS AUREUS		
BLOOD	1	BALTIMORE CITY
<b>TOTAL 1</b>		

### ISOLATES - MISCELLANEOUS

GENUS SPECIES		
SOURCE	#	JURISDICTION
ACINETOBACTER LWOFFI		
SPUTUM	3	BALTIMORE
ALCALIGENES SPECIES		
BLOOD	1	BALTIMORE CITY
BACILLUS SPECIES		
BLOOD	1	BALTIMORE CITY
CLOSTRIDIUM SPECIES		
BLOOD	1	BALTIMORE CITY
ENTEROCOCCUS AVIUM		
BLOOD	1	BALTIMORE CITY

ENTEROCOCCUS CASSELI FLAVUS		
BLOOD	1	BALTIMORE CITY
GARDNERELLA VAGINALIS		
VAGINAL	2	PRINCE GEORGE'S
KLEBSIELLA PNEUMONIAE		
VAGINAL	1	PRINCE GEORGE'S
STAPHYLOCOCCUS AUREUS		
WOUND	1	BALTIMORE
BLOOD	2	BALTIMORE CITY
BRONCHIAL	2	BALTIMORE CITY
CSF	1	BALTIMORE CITY
LUNG TISSUE	2	BALTIMORE CITY
THROAT	1	BALTIMORE CITY
WOUND	1	BALTIMORE CITY
ABSCCESS	1	CARROLL
NASAL	4	CARROLL
VAGINAL	1	PRINCE GEORGE'S
WOUND	1	PRINCE GEORGE'S
VAGINAL	1	TALBOT
STAPHYLOCOCCUS HAEMOLYTICUS		
BLOOD	1	BALTIMORE CITY
STAPHYLOCOCCUS, COAGULASE NEGATIVE		
WOUND	1	BALTIMORE
BLOOD	2	BALTIMORE CITY
WOUND	1	BALTIMORE CITY
EAR	1	CARROLL
EYE	1	CARROLL
STREPTOCOCCUS, BETA HEMOLYTIC NON-GROUP A		
THROAT	9	ALLEGANY
STREPTOCOCCUS, BETA HEMOLYTIC GROUP B		
VAGINAL	2	ANNE ARUNDEL
CERVIX	1	PRINCE GEORGE'S
VAGINAL	1	PRINCE GEORGE'S
VAGINAL	14	PRINCE GEORGE'S
STREPTOCOCCUS INTERMEDIUS		
BLOOD	1	BALTIMORE CITY
STREPTOCOCCUS ORALIS		
CSF	1	BALTIMORE CITY

**TOTAL 65**

### SEXUALLY TRANSMITTED DISEASES

GENUS SPECIES		
SEX	#	JURISDICTION
SYPHILIS SEROLOGY		
M	1	ALLEGANY
F	3	ANNE ARUNDEL
M	3	ANNE ARUNDEL
F	3	BALTIMORE
M	8	BALTIMORE
F	12	BALTIMORE CITY
M	27	BALTIMORE CITY
M	2	CAROLINE
U	1	CAROLINE
F	1	CHARLES
F	1	HARFORD
M	2	HOWARD
F	5	MONTGOMERY
M	10	MONTGOMERY

F	7	PRINCE GEORGE'S
M	31	PRINCE GEORGE'S
U	1	PRINCE GEORGE'S
F	1	SAINT MARY'S
M	1	SOMERSET
F	1	UNKNOWN
M	1	WASHINGTON
F	1	WICOMICO
M	1	WICOMICO

**TOTAL 124**

**CHLAMYDIA TRACHOMATIS**

F	6	ALLEGANY
M	5	ALLEGANY
F	29	ANNE ARUNDEL
M	12	ANNE ARUNDEL
F	20	BALTIMORE
M	16	BALTIMORE
F	18	BALTIMORE CITY
M	13	BALTIMORE CITY
U	4	BALTIMORE CITY
F	5	CALVERT
F	2	CAROLINE
M	1	CAROLINE
F	4	CECIL
M	2	CECIL
F	14	CHARLES
M	7	CHARLES
F	1	DORCHESTER
F	5	FREDERICK
M	5	FREDERICK
F	1	GARRETT
M	2	GARRETT
F	6	HARFORD
M	7	HARFORD
F	4	HOWARD
M	2	HOWARD
F	3	KENT
M	1	KENT
F	15	MONTGOMERY
M	7	MONTGOMERY
F	52	PRINCE GEORGE'S
M	36	PRINCE GEORGE'S
F	1	QUEEN ANNE'S
M	2	QUEEN ANNE'S
F	7	SAINT MARY'S
M	1	SAINT MARY'S
U	1	SAINT MARY'S
F	3	SOMERSET
M	2	SOMERSET
F	1	TALBOT
F	11	WASHINGTON
M	11	WASHINGTON
F	26	WICOMICO
M	20	WICOMICO
F	4	WORCESTER
M	3	WORCESTER

**TOTAL 398**

**NEISSERIA GONORRHOEAE**

M	1	BALTIMORE CITY
M	4	MONTGOMERY
F	11	PRINCE GEORGE'S
M	13	PRINCE GEORGE'S
F	1	WICOMICO
M	1	WICOMICO

**TOTAL 31**

**PENICILLIN-RESISTANT GONORRHEA**

REPORTED QUARTERLY 01.01.2011 - 03.31.2011

SEX	AGE	#	JURISDICTION
F	50	1	PRINCE GEORGE'S
F	49	1	PRINCE GEORGE'S
F	15	1	PRINCE GEORGE'S
M	66	1	MONTGOMERY
M	47	1	MONTGOMERY
M	29	1	PRINCE GEORGE'S
M	54	1	PRINCE GEORGE'S
M	23	1	PRINCE GEORGE'S

**TOTAL 8**

**MYCOBACTERIOLOGY**

ISOLATE  
SEX AGE # JURISDICTION

MYCOBACTERIUM ABSCESSUS

M	72	1	BALTIMORE
M	72	2	BALTIMORE CITY

MYCOBACTERIUM AVIUM

F	80	1	MONTGOMERY
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MYCOBACTERIUM AVIUM COMPLEX

F	58	1	ALLEGANY
F	71	2	ALLEGANY
F	51	1	BALTIMORE
F	56	1	BALTIMORE
F	65	1	BALTIMORE
F	81	1	BALTIMORE
F	91	1	BALTIMORE
M	61	1	BALTIMORE
M	62	6	BALTIMORE
M	64	1	BALTIMORE
M	87	1	BALTIMORE
U	56	1	BALTIMORE
F	20	1	BALTIMORE CITY
F	27	1	BALTIMORE CITY
F	47	2	BALTIMORE CITY
F	75	1	BALTIMORE CITY
M	46	1	BALTIMORE CITY
M	55	1	BALTIMORE CITY
M	52	1	CARROLL
F	85	1	FREDERICK
M	53	3	HARFORD
M	65	1	TALBOT
M	23	1	WICOMICO
M	65	1	WICOMICO

MYCOBACTERIUM CHELONAE

M	34	1	BALTIMORE CITY
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MYCOBACTERIUM FORTUITUM

M	82	1	BALTIMORE
M	85	1	BALTIMORE

MYCOBACTERIUM FORTUITUM COMPLEX

M	85	1	BALTIMORE
U	0	1	BALTIMORE CITY
F	14	1	BALTIMORE CITY
F	51	1	PRINCE GEORGE'S

MYCOBACTERIUM GORDONAE

M	51	1	BALTIMORE
F	62	1	BALTIMORE CITY
F	66	1	BALTIMORE CITY
F	89	2	BALTIMORE CITY

M	58	2	BALTIMORE CITY
M	65	1	CALVERT
M	25	1	CECIL
F	45	1	PRINCE GEORGE'S

MYCOBACTERIUM KANSASII

M	57	1	BALTIMORE CITY
M	64	1	BALTIMORE CITY
M	68	1	BALTIMORE CITY

MYCOBACTERIUM MARINUM

M	42	2	ANNE ARUNDEL
M	61	1	ANNE ARUNDEL
M	62	1	ANNE ARUNDEL

MYCOBACTERIUM TUBERCULOSIS

F	37	1	ANNE ARUNDEL
M	39	1	BALTIMORE
M	64	1	BALTIMORE
M	34	1	BALTIMORE CITY
M	39	1	BALTIMORE CITY
U	53	1	BALTIMORE CITY
M	31	1	MONTGOMERY
F	30	1	OUT OF STATE
F	50	1	OUT OF STATE
F	51	1	OUT OF STATE
M	21	1	OUT OF STATE
M	22	1	OUT OF STATE
M	29	1	OUT OF STATE
M	35	1	OUT OF STATE
M	48	1	OUT OF STATE
M	59	1	OUT OF STATE
F	46	1	PRINCE GEORGE'S
M	33	1	PRINCE GEORGE'S

MYCOBACTERIUM TUBERCULOSIS COMPLEX

F	37	2	ANNE ARUNDEL
F	66	5	BALTIMORE
M	35	1	BALTIMORE
M	39	5	BALTIMORE
M	64	2	BALTIMORE
M	68	1	BALTIMORE
F	29	2	BALTIMORE CITY
M	34	1	BALTIMORE CITY
M	39	5	BALTIMORE CITY
M	59	1	HARFORD
M	39	7	HOWARD
F	31	1	MONTGOMERY
F	63	2	MONTGOMERY
M	31	4	MONTGOMERY
F	84	1	OUT OF STATE
M	35	1	OUT OF STATE
M	59	2	OUT OF STATE
M	62	1	OUT OF STATE
M	87	1	OUT OF STATE
M	91	1	OUT OF STATE
F	46	5	PRINCE GEORGE'S
M	18	2	PRINCE GEORGE'S
M	24	2	PRINCE GEORGE'S
M	33	3	PRINCE GEORGE'S
M	35	1	PRINCE GEORGE'S
M	64	3	PRINCE GEORGE'S
M	45	2	WICOMICO

NON-PHOTOCHROMOGENIC MYCOBACTERIA

F	69	1	ALLEGANY
F	75	1	BALTIMORE

PHOTOCHROMOGENIC MYCOBACTERIA

M	81	1	BALTIMORE CITY
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SCOTOCHROMOGENIC MYCOBACTERIA

M	77	1	BALTIMORE
M	74	1	WICOMICO

**TOTAL 148**

## MYCOBACTERIUM SUSCEPTIBILITY RESULTS

12 ISOLATES IDENTIFIED

### 1 DRUG RESISTANT STRAIN FOUND

#	JURISDICTION	DRUG(S)
1	WASHINGTON DC	ISONIAZID STREPTOMYCIN

<sup>A</sup> TWO ISOLATES FROM THE SAME PATIENT

<sup>B</sup> PROBABLE FOR *M. BOVIS*

<sup>C</sup> MEETS CASE DEFINITION OF MULTI-DRUG TUBERCULOSIS (MDRTB)

*Mycobacterium tuberculosis* complex consists of:

<i>M. tuberculosis</i>	<i>M. africanum</i>
<i>M. bovis</i>	<i>M. microti</i>
<i>M. bovis, BCG</i>	<i>M. canettii</i>

## PARASITOLOGY

GENUS/SPECIES

#	JURISDICTION
<b>DIENTAMOEBIA FRAGILIS</b>	
1	PRINCE GEORGE'S
1	HOWARD
1	PRINCE GEORGE'S
1	HOWARD
<b>ENDOLIMAX NANA</b>	
3	HARFORD
1	MONTGOMERY
1	PRINCE GEORGE'S
3	HOWARD
<b>ENTAMOEBIA COLI</b>	
1	HARFORD
1	PRINCE GEORGE'S
2	MONTGOMERY
4	PRINCE GEORGE'S
1	PRINCE GEORGE'S
<b>ENTAMOEBIA HARTMANNI</b>	
2	BALTIMORE CITY
1	MONTGOMERY
1	PRINCE GEORGE'S
<b>GIARDIA LAMBLIA</b>	
2	ANNE ARUNDEL
<b>IODAMOEBIA BÜTSCHLI</b>	
3	MONTGOMERY
1	MONTGOMERY

**TOTAL 31**

## WATER MICROBIOLOGY

	# TESTED	# NON-COMPLIANT
COMMUNITY	2	0
NON-COMMUNITY	378	65
<b>TOTAL</b>	<b>380</b>	<b>65</b>

## FOOD PROTECTION

TOTALS

### FOOD

NUMBER OF SAMPLES	56
NOTABLE PATHOGENS:	
<i>CAMPYLOBACTER SP.</i>	6
<i>CLOSTRIDIUM DIFFICILE</i>	0
<i>ENTEROCOCCUS</i>	31
<i>E. COLI</i>	22
<i>E. FAECALIS</i>	0
<i>LISTERIA SP.</i>	0
<i>MRSA</i>	0
<i>SALMONELLA SP.</i>	11
<i>VRE</i>	0

### CRABMEAT

NUMBER OF SAMPLES	0
EXCEEDING STANDARDS <sup>1</sup>	0
NOTABLE PATHOGENS:	
<i>LISTERIA INNOCUA</i>	0

### SHELLFISH

NUMBER OF SAMPLES	0
EXCEEDING STANDARDS <sup>2</sup>	0
<b>TOTAL STANDARDS EXCEEDED</b>	<b>0</b>

### SHELLFISH GROWING WATERS

NUMBER OF SAMPLES	254
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**TOTAL NUMBER OF SAMPLES 380**

### STANDARDS

<sup>1</sup>CRABMEAT FRESH

*ESCHERICHIA COLI* AT < 36 MPN/100 GRAMS

STANDARD PLATE COUNT AT < 100

<sup>2</sup>SHELLFISH

FECAL COLIFORMS AT < 230 MPN/100 GRAMS

STANDARD PLATE COUNT AT < 500,000 PER GRAM

The services and facilities of the Maryland Department of Health and Mental Hygiene (DHMH) are operated on a non-discriminatory basis. This policy prohibits discrimination on the basis of age; ancestry; color; creed; marital status; mental or physical disability; national origin; race; religious affiliation, belief, or opinion; sex; or sexual orientation and plies to the provisions of employment and granting of advantages, privileges and accommodations.

The Department, in compliance with the Americans with Disabilities Act, ensures that qualified individuals with disabilities are given an opportunity to participate in and benefit from DHMH services, programs, benefits, and employment opportunities.

## VIRUS ISOLATION

ISOLATE

SEX	AGE	#	JURISDICTION
<b>HERPES SIMPLEX VIRUS TYPE 1</b>			
M	21	1	WICOMICO
U	21	1	BALTIMORE CITY
<b>INFLUENZA A VIRUS</b>			
U	26	1	CHARLES
F	44	1	HARFORD
M	56	1	BALTIMORE CITY
<b>INFLUENZA B VIRUS</b>			
M	91	1	ANNE ARUNDEL
F	49	1	CALVERT
F	36	1	CHARLES
<b>PARAINFLUENZA VIRUS 3</b>			
F	3	1	ALLEGANY
<b>RESPIRATORY SYNCYTIAL VIRUS</b>			
F	1	1	TALBOT

**TOTAL 10**

## VIRAL POLYMERASE CHAIN REACTION (PCR)

ISOLATE

SEX	AGE	#	JURISDICTION
<b>HERPES SIMPLEX VIRUS TYPE 1</b>			
U	23	1	ALLEGANY
U	26	1	ALLEGANY
F	22	1	BALTIMORE
U	48	1	BALTIMORE CITY
F	18	1	BALTIMORE CITY
F	19	2	BALTIMORE CITY
F	21	1	BALTIMORE CITY
F	22	1	BALTIMORE CITY
M	23	1	BALTIMORE CITY
F	20	1	CARROLL
F	21	1	CARROLL
F	17	1	CHARLES
M	27	1	CHARLES
F	19	1	PRINCE GEORGE'S
F	20	1	PRINCE GEORGE'S
F	24	1	PRINCE GEORGE'S
F	29	1	PRINCE GEORGE'S
M	21	1	PRINCE GEORGE'S
F	23	1	QUEEN ANNE'S
<b>HERPES SIMPLEX VIRUS TYPE 2</b>			
F	19	1	ALLEGANY
F	25	1	ANNE ARUNDEL
M	28	1	ANNE ARUNDEL
F	21	1	BALTIMORE
M	22	1	BALTIMORE
U	24	1	BALTIMORE CITY
U	26	1	BALTIMORE CITY
U	31	1	BALTIMORE CITY
F	16	1	BALTIMORE CITY
F	17	1	BALTIMORE CITY
F	18	1	BALTIMORE CITY
F	20	1	BALTIMORE CITY
F	21	1	BALTIMORE CITY
F	24	1	BALTIMORE CITY
F	26	1	BALTIMORE CITY
F	27	1	BALTIMORE CITY
F	28	2	BALTIMORE CITY
F	29	1	BALTIMORE CITY
F	31	1	BALTIMORE CITY
F	33	1	BALTIMORE CITY
M	0	1	BALTIMORE CITY
M	20	1	BALTIMORE CITY

M	22	1	BALTIMORE CITY
M	34	1	BALTIMORE CITY
M	37	1	BALTIMORE CITY
M	38	1	BALTIMORE CITY
M	47	1	BALTIMORE CITY
M	48	1	BALTIMORE CITY
M	51	1	BALTIMORE CITY
F	39	1	CARROLL
M	25	1	CARROLL
F	31	1	CECIL
M	29	1	CECIL
F	41	1	FREDERICK
F	25	1	HOWARD
F	24	1	MONTGOMERY
F	26	1	MONTGOMERY
F	38	1	MONTGOMERY
M	19	1	MONTGOMERY
M	36	1	MONTGOMERY
F	0	1	PRINCE GEORGE'S
F	16	1	PRINCE GEORGE'S
F	19	1	PRINCE GEORGE'S
F	25	1	PRINCE GEORGE'S
F	31	1	PRINCE GEORGE'S
M	21	1	PRINCE GEORGE'S
M	26	1	WICOMICO
M	32	1	WICOMICO
<b>INFLUENZA 2009 A/H1</b>			
F	42	1	ALLEGANY
M	15	1	ALLEGANY
U	1	1	BALTIMORE CITY
U	42	1	BALTIMORE CITY
U	50	1	BALTIMORE CITY
F	21	1	BALTIMORE CITY
M	48	1	BALTIMORE CITY
F	21	1	BALTIMORE CITY
M	54	1	BALTIMORE CITY
<b>INFLUENZA A(H3)</b>			
M	2	1	BALTIMORE
M	72	1	BALTIMORE
U	50	1	BALTIMORE CITY
F	0	1	BALTIMORE CITY
F	48	1	BALTIMORE CITY
F	53	1	BALTIMORE CITY
F	81	1	BALTIMORE CITY
M	61	1	BALTIMORE CITY
M	70	1	BALTIMORE CITY
M	82	1	BALTIMORE CITY
M	55	1	CALVERT
F	87	1	CHARLES
F	3	1	HARFORD
F	44	1	HARFORD
M	4	1	HARFORD
M	67	1	MONTGOMERY
F	0	1	PRINCE GEORGE'S
F	16	1	PRINCE GEORGE'S
F	4	1	PRINCE GEORGE'S
F	41	1	PRINCE GEORGE'S
<b>INFLUENZA B VIRUS</b>			
M	66	1	ALLEGANY
F	86	1	ANNE ARUNDEL
F	91	1	ANNE ARUNDEL
M	91	1	ANNE ARUNDEL
U	8	1	BALTIMORE
M	90	1	BALTIMORE
U	8	1	BALTIMORE CITY
F	1	1	BALTIMORE CITY
F	38	1	BALTIMORE CITY
F	73	1	BALTIMORE CITY
M	3	1	BALTIMORE CITY
M	45	1	BALTIMORE CITY
M	6	2	BALTIMORE CITY
U	11	1	CECIL
U	42	1	CECIL
F	0	1	CECIL

F	1	1	CECIL
F	20	1	CECIL
M	73	1	CECIL
F	36	1	CHARLES
M	1	1	CHARLES
M	5	1	CHARLES
U	2	1	HARFORD
F	10	1	HARFORD
F	18	1	HARFORD
F	9	1	HARFORD
F	0	1	PRINCE GEORGE'S
F	2	1	PRINCE GEORGE'S
F	23	1	PRINCE GEORGE'S
F	24	1	PRINCE GEORGE'S
F	44	1	PRINCE GEORGE'S
F	64	1	PRINCE GEORGE'S
M	30	1	PRINCE GEORGE'S
F	5	1	TALBOT

**TOTAL 133**

### VIRAL HEPATITIS

ORGANISM	# SPECIMENS		JURISDICTION
	#	POSITIVES	
HEPATITIS A	2	0	BALTIMORE
SUBTOTAL	2	0	
HEPATITIS B	62	2	ALLEGANY
	143	1	ANNE ARUNDEL
	48	0	BALTIMORE
	319	6	BALTIMORE CITY
	5	0	CALVERT
	18	0	CARROLL
	205	0	CECIL
	3	0	CHARLES
	2	0	DORCHESTER
	29	0	FREDERICK
	17	0	GARRETT
	39	1	HARFORD
	27	1	HOWARD
	1	0	KENT
	306	3	MONTGOMERY
	350	5	PRINCE GEORGE'S
	2	0	QUEEN ANNE'S
	7	0	SAINT MARY'S
	2	0	SOMERSET
	3	0	TALBOT
	1	0	UNKNOWN
	43	0	WASHINGTON
	59	0	WICOMICO
<b>SUBTOTAL</b>	<b>1,691</b>	<b>19</b>	
HEPATITIS C	53	4	ALLEGANY
	175	27	ANNE ARUNDEL
	42	4	BALTIMORE
	199	51	BALTIMORE CITY
	5	0	CALVERT
	19	2	CARROLL
	93	8	CECIL
	1	0	CHARLES
	2	0	DORCHESTER
	28	4	FREDERICK
	19	0	GARRETT
	49	2	HARFORD
	13	1	HOWARD
	1	0	KENT

105	1	MONTGOMERY
219	3	PRINCE GEORGE'S
2	0	QUEEN ANNE'S
7	1	SAINT MARY'S
1	0	SOMERSET
3	0	TALBOT
1	0	UNKNOWN
14	3	WASHINGTON
9	1	WICOMICO

**SUBTOTAL 1,060 112**

**TOTALS 2,753 131**

### RABIES

SOURCE	#	JURISDICTION
BAT	1	BALTIMORE CITY
	1	KENT
DOG	1	CHARLES
FOX	1	HARFORD
	1	MONTGOMERY
	1	PRINCE GEORGE'S
GROUND HOG	1	MONTGOMERY
RACCOON	1	ANNE ARUNDEL
	1	BALTIMORE
	1	BALTIMORE CITY
	1	CARROLL
	2	CHARLES
	1	DORCHESTER
	1	FREDERICK
	1	GARRETT
	1	HARFORD
	3	HOWARD
	3	MONTGOMERY
	1	PRINCE GEORGE'S
	1	QUEEN ANNE'S
	1	SAINT MARY'S
	2	TALBOT
	1	WASHINGTON
	2	WORCESTER

**TOTAL POSITIVES 31**

**TOTAL SPECIMENS 220**

### CHLAMYDIOPHILIA PSITTACI (CHLAMYDIA)

REPORTED QUARTERLY  
NONE REPORTED 01.01.2011 - 03.31.2011

### VIRAL DISEASE ASSESSMENT - HIV

LYMPHOCYTE PHENOTYPING  
(METHOD - FLOW CYTOMETRY)

DATES Quarterly comparison 2010-2011	% CD4 LYMPHOCYTES			TOTAL
	<14%	14%- 28%	≥29%	
01.01.2011 - 03.31.2011	133	350	269	752
01.01.2010 - 03.31.2010	152	401	281	834

## NEWBORN & CHILDHOOD SCREENING

### PRESUMPTIVE POSITIVES

DISORDERS	#
PHENYLKETONURIA (PKU)	2
MAPLE SYRUP URINE DISEASE (MSUD)	1
HOMOCYSTEINURIA	10
TYROSINEMIA	16
ARGININEMIA	1
CITRULLINEMIA	0
GALACTOSEMIA	3
BIOTINIDASE DEFICIENCY	1
HYPOTHYROIDISM	56
HEMOGLOBIN -DISEASE	27
HEMOGLOBIN -BENIGN	486
CONGENITAL ADRENAL HYPERPLASIA (CAH)	12
CYSTIC FIBROSIS	2
FATTY ACID OXIDATIONS	16
ORGANIC ACIDEMIAS	9
ACYLCARNITINE - BORDERLINE	3
ACYLCARNITINE - OTHERS	0
<b>MONTHLY TOTALS</b>	
# OF SPECIMENS SCREENED	12,677
NUMBER OF TESTS	799,987
% UNSATISFACTORY SPECIMENS	2.2
<b>2011 YEAR-TO-DATE CONFIRMED CASES</b>	
CONDITIONS	# CONFIRMED
MEDIUM CHAIN ACYL-CoA DEHYDROGENASE DEFICIENCY (MCAD)	1
SHORT CHAIN ACYL-CoA DEHYDROGENASE DEFICIENCY (SCAD)	1
VERY LONG-CHAIN ACY-Co-A DEHYDROGENASE DEFICIENCY (VLCAD) - CARRIER	1
CARNITINE DEFICIENCY (MATERNAL)	1
CITRULLINEMIA (CIT)	1
TYROSINEMIA III	1
HYPOTHYROIDISM - PRIMARY	8
OTHER HYPOTHYROIDISM	3
TBG DEFICIENCY	2
CONGENITAL ADRENAL HYPERPLASIA-SALT WASTING	1
BIOTINIDASE DEFICIENCY - CARRIER	1
CYSTIC FIBROSIS	3
GALACTOSEMIA - VARIANT -DG	1
GALACTOSEMIA - VARIANT -DN	1
SICKLE CELL DISEASE -SS	5
SICKLE CELL DISEASE -SC	2

## ENVIRONMENTAL CHEMISTRY

SAMPLE TYPES	# NON-COMPLIANT	# TESTED
<b>ASBESTOS</b>		
AIR	0	0
BULK	18	26
<b>AIR QUALITY</b>		
PM 2.5	0	455
<b>RADIATION</b>		
AIR/CHARCOAL FILTERS	0	88
MILK	0	3
WIPES	0	216
RAW WATER	0	8
VEGETATION	0	0
OTHER	0	0
<b>DRINKING WATER</b>		
<b>METALS</b>		
COMMUNITY	3	11
NON-COMMUNITY	1	3
PRIVATE WELLS	14	138
<b>PESTICIDES &amp; PCBs</b>		
COMMUNITY	0	89
NON-COMMUNITY	0	30
PRIVATE WELLS	0	12
<b>VOLATILE ORGANIC COMPOUNDS</b>		
COMMUNITY	0	158
NON-COMMUNITY	0	58
PRIVATE WELLS	0	34
<b>RADIATION</b>		
COMMUNITY	1	60
NON-COMMUNITY	0	28
PRIVATE WELLS	0	0
<b>INORGANICS</b>		
COMMUNITY	1	6
NON-COMMUNITY	2	156
PRIVATE WELLS	8	147
<b>FOOD CHEMISTRY</b>		
SUSPECTED TAMPERING	0	0
MICROSCOPIC FILTH	0	0
LABELING	0	0
SURVEILLANCE	0	9
CHEMICAL CONTAMINATION	0	0
<b>TOTAL</b>	<b>48</b>	<b>1,735</b>

### VIRAL LOAD SPECIMENS

HIV-1 RNA COPIES/ML	<10 <sup>3</sup>	10 <sup>3</sup> —10 <sup>4</sup>	10 <sup>4</sup> —10 <sup>5</sup>	>10 <sup>5</sup>	TOTALS
ALLEGANY	7	2	1	0	10
CARROLL	0	0	1	0	1
FREDERICK	5	2	0	1	8
MONTGOMERY	79	7	5	1	92
PRINCE GEORGE'S	96	13	11	4	124
WASHINGTON	5	0	0	0	5
WICOMICO	1	0	1	0	2
<b>SUBTOTALS</b>	<b>193</b>	<b>24</b>	<b>19</b>	<b>6</b>	<b>242</b>
DEPT. OF CORRECTIONS	20	0	1	0	21
<b>TOTALS</b>	<b>213</b>	<b>24</b>	<b>20</b>	<b>6</b>	<b>263</b>

### HIV ANTIBODY SCREENING

SUBMITTER	TOTAL SPECIMENS	#EIA POSITIVE	% EIA POSITIVE	#WB POSITIVE	% WB POSITIVE
CORRECTION FACILITY JUVENILE	69	2	2.90%	2	100.00%
CORRECTIONAL INSTITUTIONS	187	2	1.07%	2	100.00%
FAMILY PLANNING (NON-GOVERNMENT)	54	1	1.85%	1	100.00%
HEALTH CENTERS (NON-GOVERNMENT)	328	20	6.10%	18	90.00%
HEALTH DEPT, NON-STD, FAMILY PLANNING	314	1	0.32%	1	100.00%
HEALTH DEPT, NON-STD, OB/GYN	93	1	1.08%	0	0.00%
HEALTH DEPT, NON-STD, OTHER	442	32	7.24%	31	96.88%
HEALTH DEPT, STD CLINICS	991	14	1.41%	12	85.71%
HOSPITAL, OTHER	114	6	5.26%	5	83.33%
HOSPITAL, PUBLIC	30	0	0.00%	0	0.00%
LABORATORIES (NON-HOSPITAL)	314	11	3.50%	7	63.64%
PEDIATRIC - CHILD HEALTH	7	0	0.00%	0	0.00%
PRIVATE PHYSICIANS	2	0	0.00%	0	0.00%
PRIVATE STUDENT HEALTH CTRS	41	0	0.00%	0	0.00%
PUBLIC STUDENT HEALTH CTRS	227	0	0.00%	0	0.00%
<b>TOTALS</b>	<b>3,213</b>	<b>90</b>	<b>2.80%</b>	<b>79</b>	<b>87.78%</b>



MAILING LABEL

**Critical Link**  
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 J. Mehsen Joseph Public Health Laboratory  
 Department of Health & Mental Hygiene  
 201 West Preston Street  
 Baltimore, Maryland 21201

