CRITICAL LINK

John M. Colmers
Secretary

A Publication of the Maryland Department of Health and Mental Hygiene

The Laboratories Administration—Maryland's State Public Health Laboratory

Drug Resistance on the Rise

Controlling infectious diseases

Overall, infectious diseases (IDs) remain the third leading cause of death in the US.[1] We continue to struggle with IDs because of antibiotic resistance and we need to apply a more judicious use of antibiotics.

Background

Emerging bacterial resistance to antimicrobial agents has been previously described.[2,3,4,5] Some resistant strains are reemerging by spreading to other populations outside healthcare facilities. According to the findings of Tracking Resistance in the United States Today (TRUST), resistance among *Streptococcus pneumoniae* continues to be problematic as it rises every year.[6] Methicillin-Resistant *Staphylococcus aureus* (MRSA) is certainly no less of a threat whether it's originating within or from outside a hospital. Vancomycin-Resistant *Enterococcus* (VRE), although not as virulent as MRSA, can transfer its vancomycin resistance to MRSA, forcing clinicians to seek alternative drugs such as clindamycin, linezolid, telavancin, or tigecycline. Likewise, extended spectrum β-lactamase producing gram negative bacilli (ESBLs) and *Klebsiella pneumoniae*-like Carbapenemase producers (KPCs) are continuing to present problems by tolerating the commonly used antibiotics and transferring their plasmid-mediated resistance factors to other species.[7]

Acinetobacter, known to be quite resistant to most common drugs, has been increasing in the community. Patients, usually over 60, nosocomially acquire *Acinetobacter* after admission to a hospital, during which time the bacterium becomes even more resistant and to additional drugs. When the patients-either colonized or infected with this organism-are discharged, they can introduce the resistant microbe to homes, nursing homes, long-term acute care facilities, other hospitals, or hospices.[8] In addition, particularly hypervirulent, toxigenic strains of microorganisms, such as BI/NAP/027 of *Clostridium difficile,* pose a deadly threat to patients when exposed.[9]

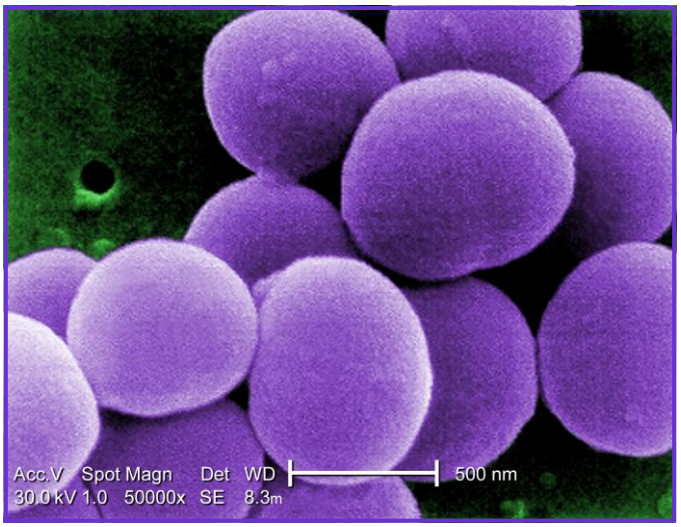

Photo 1: Under a very high magnification of 50,000x, this scanning electron micrograph (SEM) shows a strain of *Staphylococcus aureus* bacteria taken from a vancomycin intermediate resistant culture (VISA). Source: CDC Public Image Library

Antibiotic Overuse

This emergence of healthcare-associated infections and their re-emergence as antibiotic resistant infections is attributable to overuse and misuse of

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Drug Resistance on the Rise

antibiotics. Up to half of antibiotic prescriptions written in the U.S. are unnecessary. In a chart-by-chart study of nearly 1,400 patients hospitalized in 2000, it was reported that the average medical cost per patient with an ARI was up to $29K, not to mention spending a week or two in the hospital.[10]

Most antibiotics are prescribed for acute respiratory infections, most of which are viral. Most primary bacterial infections encountered in hospitals are resistant to at least one drug commonly used to treat it.

If the back-up drug or antibiotic, held as a last resort for microbes (found to be resistant to the usual first-line drug of choice), is used up front for a primary infection, it is selecting for a secondary infection by a bacterium that will be resistant to that drug, too. This defeats the strategy of holding the 'big gun' drugs in reserve for severe super-infections, and leaves a situation with little or no recourse to treat effectively with antibiotics.

Individuals who receive antibiotics for respiratory tract or urinary tract infections seem to be the most at risk for ARIs.[11] This risk may last for a year but is highest during the first post-treatment month. The highest risk of antibiotic resistance is linked to longer duration and multiple doses of antibiotics.[12] No particular class of antibiotics is favored.

All antimicrobial agents are associated with risk of *C. difficile* infection[13] although many community-acquired infections now lack the traditional risk factor of exposure to an antimicrobial drug.[9] Pediatric incidence is being noted as more children are hospitalized for rotavirus. Could this be due to having been treated unsuccessfully with an antibiotic prior to admission? If so, perhaps future immunization with a rotavirus vaccine may preclude a significant portion of gastrointestinal illness leading to hospitalization.

Antimicrobials fed to food animals (chickens, cattle, etc.) as growth promoters are carried up the food chain to humans. This seems evident by the incidence of human gastroenteritis caused by fluoroquinolone-resistant *Campylobacter* (FRC) along with a rise of the FRC in chickens, and its absence where banned in food production animals.[14] Penicillin and sulfa drug residues higher than permitted have been found in cattle in New York.[15]

This year, testimony provided at a House subcommittee hearing on 'Antibiotic Resistance and the Threat to Public Health' stated that there is strong evidence of the spread (of resistance) between feed animals and people in that environment, and the restricted use of antibiotics reduced resistant organisms in the community.[16]

Prevention

Certain current practices will need to be modified to turn the tide of ARIs. For example, over half of ambulatory surgical centers surveyed were cited for infection control deficiencies.[17] Heightened awareness can exert better control to the spread of infection by exercising key preventive measures. Most infections are spread through hand contact.[18] Old fashioned soap and water with friction physically dislodges dirt and germs to send them down the drain.[19] The recommended duration of hand washing is at least as long as it takes to sing the Happy Birthday Song (or 15 seconds.)[20]

Contaminated surfaces in hospital patient rooms have also been shown to be a source of pathogen transmission. Improved terminal room cleaning and disinfecting practices have become an important infection control measure to reduce environmental contamination. U.S. hospitals commonly use fast-acting quaternary ammonium compounds (even though some bacteria, like *pseudomonas*, will grow in it). Current guidelines recommend 10% bleach to deal with especially difficult pathogens such as the spores of *C. difficile* or the non-enveloped virus. Canadian hospitals have recently begun to use activated hydrogen peroxide liquids.[21,22]

Vaccination also is a major preventive measure. Some parents have refused vaccines for their children for fear of the preservative thimerosal (containing mercury) causing autism. Such theory has no scientific evidence, but could undercut childhood vaccination programs and lead to loss of protective

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Drug Resistance on the Rise

group immunity and to epidemics of reemerging diseases from the past.[1] Other important practices in the control of ID are appropriate sewage treatment, food safety, and animal inspection programs.

Another means used to prevent the unnecessary use of antibiotics is a diagnostic test to measure serum levels of the hormone precursor procalcitonin (PCT). It has been used to differentiate a bacterial infection immune response from a viral infection or an inflammatory process (unlinked to a pathogen).[10] Particularly useful in hospital emergency departments, PCT is monitored for a spike, indicative of a bacterial infection. If the increased level continues over a day or two, it strongly indicates that the patient is **not** on the appropriate antimicrobial regimen, or that the infectious agent is resistant to whatever drug is being used.

Lessons learned from the past would tend to heighten our awareness for the possible concomitant staph superinfection in viral influenza patients. Many individuals have died in past and recent flu outbreaks from this complication when recognized too late. So when covering for a bacterial super-infection of a patient with the flu, *S. aureus* (even MRSA) must be considered in the coverage pending culture results. If cultures are negative, the antibiotics can be stopped.

When encountering infectious colitis caused by *C. difficile*, before resorting to antibiotics which may eventually become ineffective, alternate therapeutic regimens should be considered. The first step is to immediately discontinue antibiotics that a patient might be taking. Then re-introduce normal intestinal flora into the patient artificially by re-colonizing the gut with *Lactobacillus acidophilus*-like flora or even direct colonic content transfer from a close, cohabitating relative. While sounding extreme, this could save the patient from a terribly painful disease course possibly leading to a fatal outcome.[10]

Aside from reconsideration of bacteriophages[23] there is a group of new anti-infectives with hopeful potential for the future. The drugs in this group, called defensins, are small, cationic, [disulfide bond-containing] cysteine and arginine-rich antimicrobial peptides, similar to those natural toxins found in neutrophils and intestinal epithelia.[24,25] They selectively act on the cholesterol-free, negatively charged phospholipid membranes of bacteria to disrupt their structure and function.[25,26] Development of resistance is thought to be unlikely because this mechanism of action is so radically different from those biochemical mechanisms of other antibiotics.[24]

Preferential action on bacterial membranes over mammalian membranes is thought to be influenced by the negatively charged acidic phospholipid-rich bacterial membranes and the stabilizing effect of cholesterol in mammalian membranes. Phase I safety profiles of a prospective candidate from this group have been encouraging to date. The ability to alter bacterial membranes gives these unique molecules bactericidal properties.[24] A defensin has just been discovered in medical-grade honey as the antibacterial factor added to the honey by the bees.[27] Defensins also have been demonstrated to possess immunomodulatory capabilities that promote wound healing.[26]

However, there are researchers who theorize that resistance may arise from changes in the outer membrane proteins, from bacterial efflux pumps known to expel antimicrobial agents, or from degradation by proteolytic enzymes produced by bacteria.[26] It is hoped that some member of this family of antimicrobials could succeed in vanquishing some of today's "superbugs."

Finally, there is the 'Hygiene Hypothesis.' It espouses that exposure to microorganisms in our environment, especially those found in the soil, can have the beneficial effects of fine tuning the immune system and even preventing immune system-mediated diseases. The proponents of this belief would have us put down the hand sanitizer outside the healthcare setting and go play in the dirt.[28]

Meanwhile, public health surveillance and response remain critical for detection, diagnosis, and containment regarding new ID threats, whether emerging or re-emerging.

This article was written by Robert Waltersdorff, Ph.D.

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New Public Health Laboratory to Employ New Technology

Incineration to be replaced with tissue digestion

Since moving into its current location in the O'Conor Building in 1974, the Laboratories Administration has relied on incineration to dispose of carcasses remaining after animals undergo necropsy prior to rabies testing. Over the years the public health laboratory's incinerator also has served other purposes such as occasionally burning old paper money removed from circulation at the request of the Baltimore office of the Federal Reserve Bank.

However, over the past 40 years, as the environmental impacts of incinerators have been subjected to closer scrutiny, regulatory requirements for burning within Baltimore City have greatly increased. Today the Laboratories Administration must maintain a license to operate its incinerator, the incinerator must meet soot discharge limits, and our incinerator operator must undergo annual training and recertification. The incinerator also requires costly maintenance to meet discharge limits. Within the last 10 years the incinerator also required expensive retrofitting that included a total replacement of the incinerator flue that runs through all seven floors of the laboratory tower.

As part of its desire to be a good neighbor when it moves to its new location in East Baltimore, the Laboratories Administration decided not to build an incinerator in its new facility. This left the Administration in an initial quandary because it still needed to dispose of carcasses containing biological agents without having to have them hauled away.

One alternative to incineration is to employ steam sterilization. However, while steam sterilization may be acceptable for small birds or rodents, ensuring decontamination of larger animals requires an inordinate amount of sterilization time. In addition, sterilization does not render the carcass remains unrecognizable and leaves a stew-like odorous mess that still requires final disposal by hauling it away to an off-site commercial incinerator.

Photo 1: A 280 lb. digester.
Photo source: BioSAFE/WR2

A second alternative to incineration is a technology that has been available for over 15 years within schools of veterinary medicine and large animal agriculture facilities that must dispose of large animals on a routine basis. This technology, known as alkaline hydrolysis tissue digestion, is based on the decontamination and digestion of carcasses using steam heated aqueous sodium hydroxide or potassium hydroxide, inside what amounts to a large pressure cooker. The author has personally observed carcasses of entire horses and cows fully digested in only 8-10 hours after being placed inside a large tissue digester at the Ohio State Veterinary School. The alkali is consumed in the process by generating the salts of the hydrolysis products. Digested materials are safely and automatically flushed into the sewer system without stressing the environment.

What is left in the vessel's collection basket after digestion are the mineral constituents of the bones and teeth of vertebrates. Those remnants are soft enough after the organic matter has been degraded to be easily crushed by hand and, if desired, can be recovered as calcium phosphate powder (sterile bone meal).

Digester systems come in various sizes, from those that are geared for small animals that may hold around 30 pounds, to those geared to large farm animals that can hold over four tons. If necessary a 500-pound capacity digester can run two 6-hour cycles per day (one in the morning and one after normal work hours).

Tissue digestion using aqueous sodium hydroxide and steam under pressure has been shown to safely and fully destroy all microorganisms ranging from mycobacterium and Giardia cysts to viruses and prions.[1] In the case of prion-contaminated material, tissue digestion is safer and more effective than incineration because incinerator fly ash has been found to retain sufficient infective material to possibly expose human and animal populations.[2]

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New P.H. Laboratory to Employ New Technology

Costs must also be taken into account when considering moving from one technology to another. Steam sterilization equipment and its maintenance are less expensive than tissue digestion using alkaline hydrolysis. However, the cost of digesting carcasses (approximately 16¢ per pound) is much less than steam sterilization (approximately 85¢ per pound) when labor and commercial waste hauling are factored in to the final costs. The Laboratories Administration currently disposes of 16,000 to 20,000 pounds of carcasses per year, depending on annual variation associated with the number and size of zoonotic outbreaks.

While the reliability of digester technology has proven itself over the past two decades, manufacturers fully support this reliability with a semi-annual equipment preventive maintenance program. This includes two on-site visits per year to ensure optimum operation by re-building valves, replacing gaskets, and replacing pump seals. There are no moving parts inside the digester vessel and any component requiring servicing is accessible in the piping located below and next to the vessel. This means equipment down-time is limited to one to two days during each semi-annual servicing.

The Laboratories Administration will be the first state public health laboratory in the U.S. to install a tissue digester as a routine means of disposing of carcasses. This will be just one of a number of cutting edge equipment and operations identified for Maryland's new central public health laboratory. These types of infrastructural improvements will pave the way for more efficient and effective operations not only in Maryland but also for state public health laboratories throughout the country.

This article written by Dr. Jack DeBoy

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Laboratory Statistics

Reported from the
Laboratories Administration
during the month of
June 2010

ENTERIC BACTERIOLOGY

GENUS SEROVAR	SEX	AGE	#	JURISDICTION
CAMPYLOBACTER JEJUNI				
	U	0	2	ANNE ARUNDEL
	M	21	1	ANNE ARUNDEL
	M	19	1	ANNE ARUNDEL
	F	57	1	BALTIMORE
	F	42	1	BALTIMORE
	F	42	1	BALTIMORE
	F	28	1	BALTIMORE
	F	4	1	BALTIMORE
	M	0	1	BALTIMORE
	M	50	1	BALTIMORE
	M	49	1	BALTIMORE
	M	46	1	BALTIMORE
	M	30	1	BALTIMORE
	F	33	1	BALTIMORE CITY
	M	31	1	BALTIMORE CITY
	M	39	1	CHARLES
	U	54	1	KENT
	M	61	1	KENT
	M	17	1	KENT
	M	43	1	MONTGOMERY
	M	27	1	MONTGOMERY
	U	55	1	OUT OF STATE
	U	43	1	OUT OF STATE
	U	39	1	OUT OF STATE
	U	36	1	OUT OF STATE
	U	3	1	OUT OF STATE
	F	67	1	OUT OF STATE
	F	56	1	OUT OF STATE
	F	48	1	OUT OF STATE
	F	10	1	OUT OF STATE
	F	8	1	TALBOT
	M	10	1	TALBOT
CAMPYLOBACTER SP.				
	F	32	1	OUT OF STATE
ESCHERICHIA COLI, SEROTYPE O157:H7				
	M	85	1	WASHINGTON
	M	1	1	WASHINGTON
SALMONELLA				
	M	11	2	BALTIMORE CITY
	M	7	1	OUT OF STATE
SALMONELLA SER. 4,12:I:-				
	M	5	1	TALBOT
SALMONELLA SER. 4,5,12:I:-				
	M	10	1	ANNE ARUNDEL
	M	43	1	BALTIMORE CITY
	F	3	1	OUT OF STATE
	F	57	2	OUT OF STATE
SALMONELLA SER. BAREILLY				
	F	13	1	ANNE ARUNDEL
	M	1	1	BALTIMORE
SALMONELLA SER. BERTA				
	F	0	1	PRINCE GEORGE'S
SALMONELLA SER. ENTERITIDIS				
	F	67	1	ALLEGANY
	U	63	1	ANNE ARUNDEL
	U	61	1	ANNE ARUNDEL
	F	4	1	BALTIMORE
	F	2	1	BALTIMORE
	M	4	1	BALTIMORE
	U	0	1	BALTIMORE CITY
	F	0	1	BALTIMORE CITY
	M	59	1	BALTIMORE CITY
	M	55	1	BALTIMORE CITY
	M	10	1	BALTIMORE CITY
	M	3	1	BALTIMORE CITY
	U	72	2	BALTIMORE CITY
	F	23	1	CARROLL
	M	16	1	CARROLL
	U	0	1	HARFORD
	M	35	1	HARFORD
	F	66	1	MONTGOMERY
	F	35	1	MONTGOMERY
	M	2	1	MONTGOMERY
	U	26	1	OUT OF STATE
	F	42	1	OUT OF STATE
	F	32	1	OUT OF STATE
	F	20	1	OUT OF STATE
	F	3	1	OUT OF STATE
	M	34	1	OUT OF STATE
	M	22	1	OUT OF STATE
	F	15	1	WASHINGTON
SALMONELLA SER. HEIDELBERG				
	F	6	1	BALTIMORE CITY
	F	22	1	BALTIMORE CITY
	M	0	1	BALTIMORE CITY
	U	0	1	BALTIMORE CITY
SALMONELLA SER. POONA				
	F	23	1	HARFORD
	M	1	1	OUT OF STATE
SALMONELLA SER. SAINTPAUL				
	M	2	1	ANNE ARUNDEL
	F	94	1	BALTIMORE
	M	7	1	BALTIMORE
	F	0	1	WASHINGTON
SALMONELLA SER. THOMPSON				
	F	33	1	BALTIMORE
	F	19	1	BALTIMORE
SALMONELLA SER. TYPHIMURIUM				
	M	21	1	OUT OF STATE
	M	17	2	OUT OF STATE
SALMONELLA SER. TYPHIMURIUM VAR COPENHAGEN				
	M	2	2	WASHINGTON
SHIGELLA FLEXNERI				
	M	27	1	MONTGOMERY
SHIGELLA FLEXNERI VI:(4)				
	F	0	1	BALTIMORE CITY
SHIGELLA SONNEI				
	U	2	1	BALTIMORE
	M	46	1	BALTIMORE
	F	20	1	CHARLES
	U	2	1	OUT OF STATE
	U	85	1	OUT OF STATE
VIBRIO PARAHAEMOLYTICUS				
	M	33	1	BALTIMORE
	U	69	1	BALTIMORE
VIBRIO VULNIFICUS				
	U	16	1	OUT OF STATE
YERSINIA ENTEROCOLITICA				
	M	0	1	ANNE ARUNDEL
YERSINIA SPECIES PRESENT SENT TO CDC FOR FURTHER ID				
	U	0	1	BALTIMORE CITY
TOTAL			**106**	

ISOLATES - REFERENCE

GENUS SPECIES / SOURCE	#	JURISDICTION
KLEBSIELLA PNEUMONIAE		
URINE	1	WICOMICO
STAPHYLOCOCCUS AUREUS		
WOUND	1	WICOMICO
TOTAL	**2**	

ISOLATES - MISCELLANEOUS

GENUS SPECIES / SOURCE	#	JURISDICTION
CLOSTRIDIUM SEPTICUM		
ABSCESS	1	BALTIMORE CITY
CORYNEBACTERIUM AFERMENTANS		
BLOOD	1	BALTIMORE CITY
ENTEROBACTER CLOACAE		
BLOOD	1	BALTIMORE CITY
ENTEROCOCCUS FAECALIS		
BLOOD	1	BALTIMORE CITY
WOUND	1	PRINCE GEORGE'S
ESCHERICHIA COLI		
BLOOD	3	BALTIMORE CITY
CSF	1	BALTIMORE CITY
LYMPH NODE	1	BALTIMORE CITY
VAGINAL	2	MONTGOMERY
GARDNERELLA VAGINALIS		
VAGINAL	4	PRINCE GEORGE'S
VAGINAL	1	PRINCE GEORGE'S
LACTOBACILLUS SPECIES		
BLOOD	1	BALTIMORE CITY
PANTOEA AGGLOMERANS		
WOUND	1	PRINCE GEORGE'S
STAPHYLOCOCCUS AUREUS		
BLOOD	1	BALTIMORE CITY
SKIN	1	BALTIMORE CITY
WOUND	4	BALTIMORE CITY
LABIA	1	CARROLL
NASAL	4	CARROLL
WOUND	1	CARROLL
VAGINAL	1	PRINCE GEORGE'S
SPUTUM	1	WASHINGTON
OTHER	1	WICOMICO
STAPHYLOCOCCUS CAPITIS		
BLOOD	1	BALTIMORE CITY
STAPHYLOCOCCUS, COAGULASE NEGATIVE		
BLOOD	3	BALTIMORE CITY
STREPTOCOCCUS, BETA HEMOLYTIC GROUP A		
THROATS	19	ALLEGANY
STREPTOCOCCUS, BETA HEMOLYTIC NON-GROUP A		
THROATS	1	ALLEGANY
STREPTOCOCCUS, BETA HEMOLYTIC GROUP B		
VAGINAL	4	ANNE ARUNDEL
BLOOD	2	BALTIMORE CITY
VAGINAL	1	MONTGOMERY
VAGINAL	8	PRINCE GEORGE'S
VAGINAL	18	PRINCE GEORGE'S
WOUND	1	TALBOT
STREPTOCOCCUS UBERIS		
BLOOD	1	BALTIMORE CITY
TOTAL	**93**	

SEXUALLY TRANSMITTED DISEASES

GENUS SPECIES / SEX	#	JURISDICTION
SYPHILIS SEROLOGY		
M	1	ANNE ARUNDEL
F	3	BALTIMORE
M	7	BALTIMORE
F	23	BALTIMORE CITY
M	29	BALTIMORE CITY
F	1	CALVERT
F	1	CECIL
F	1	DORCHESTER
U	1	HARFORD
F	3	MONTGOMERY
M	10	MONTGOMERY
F	5	PRINCE GEORGE'S
M	31	PRINCE GEORGE'S
U	1	PRINCE GEORGE'S
F	2	WICOMICO
M	5	WICOMICO
TOTAL	**124**	
CHLAMYDIA TRACHOMATIS		
F	4	ALLEGANY
M	6	ALLEGANY
F	25	ANNE ARUNDEL
M	11	ANNE ARUNDEL
F	22	BALTIMORE
M	11	BALTIMORE
F	11	BALTIMORE CITY
M	17	BALTIMORE CITY
F	3	CALVERT
M	1	CALVERT
F	1	CAROLINE
F	5	CARROLL
M	3	CARROLL
F	1	CECIL
F	15	CHARLES
M	7	CHARLES
M	5	DORCHESTER
F	4	FREDERICK
F	2	GARRETT
F	5	HARFORD
M	5	HARFORD
F	2	HOWARD
M	4	HOWARD
F	3	KENT
M	2	KENT
F	19	MONTGOMERY
M	2	MONTGOMERY
F	67	PRINCE GEORGE'S
M	67	PRINCE GEORGE'S
U	1	PRINCE GEORGE'S
F	3	QUEEN ANNE'S
F	2	SAINT MARY'S
F	8	SOMERSET
M	11	SOMERSET
U	1	SOMERSET
F	2	TALBOT
M	2	TALBOT
F	3	WASHINGTON
M	5	WASHINGTON
F	14	WICOMICO
M	8	WICOMICO
U	1	WICOMICO
F	5	WORCESTER
M	5	WORCESTER
TOTAL	**401**	
NEISSERIA GONORRHOEAE		
M	2	ALLEGANY
F	1	ANNE ARUNDEL
M	1	BALTIMORE
U	1	BALTIMORE
M	1	BALTIMORE CITY
F	1	CHARLES
M	5	CHARLES
M	4	DORCHESTER
F	1	MONTGOMERY
M	8	MONTGOMERY
F	10	PRINCE GEORGE'S
M	21	PRINCE GEORGE'S
F	5	WICOMICO
M	4	WICOMICO
M	2	WORCESTER
TOTAL	**67**	

PENICILLIN RESISTANT GONORRHEA

REPORTED QUARTERLY 4-01-10 TO 7-31-10

SEX	AGE	#	JURISDICTION
F	18	1	ANNE ARUNDEL
M	18	1	BALTIMORE
M	19	1	MONTGOMERY
M	22	1	MONTGOMERY
F	17	1	PRINCE GEORGE'S
F	22	1	PRINCE GEORGE'S
F	23	1	PRINCE GEORGE'S
M	19	1	PRINCE GEORGE'S
M	24	1	PRINCE GEORGE'S
M	25	1	PRINCE GEORGE'S
M	26	2	PRINCE GEORGE'S
TOTAL		**12**	

MYCOBACTERIOLOGY

ISOLATE / SEX	AGE	#	JURISDICTION
ACID-FAST BACILLUS			
M	55	1	ANNE ARUNDEL
MYCOBACTERIUM ABSCESSUS			
M	58	1	BALTIMORE
F	61	1	BALTIMORE CITY
MYCOBACTERIUM AFRICANUM			
F	25	1	BALTIMORE
MYCOBACTERIUM AVIUM COMPLEX			
F	3	1	ALLEGANY
M	80	1	ANNE ARUNDEL

F	73	1	BALTIMORE
M	60	2	BALTIMORE
M	86	1	BALTIMORE
F	36	1	BALTIMORE CITY
F	52	2	BALTIMORE CITY
F	91	1	BALTIMORE CITY
M	31	1	BALTIMORE CITY
M	44	1	BALTIMORE CITY
M	49	1	BALTIMORE CITY
M	56	1	BALTIMORE CITY
M	77	1	BALTIMORE CITY
M	0	1	CARROLL
F	53	1	FREDERICK
F	63	1	FREDERICK
M	50	1	FREDERICK
M	19	1	MONTGOMERY
M	47	1	MONTGOMERY
F	82	1	TALBOT
MYCOBACTERIUM FORTUITUM			
M	61	1	BALTIMORE
MYCOBACTERIUM FORTUITUM COMPLEX			
M	84	1	BALTIMORE CITY
F	53	1	FREDERICK
F	33	1	HOWARD
M	40	1	MONTGOMERY
M	66	1	OUT OF STATE
MYCOBACTERIUM GORDONAE			
M	65	1	FREDERICK
M	45	1	OUT OF STATE
M	25	1	WICOMICO
MYCOBACTERIUM KANSASII			
M	68	1	BALTIMORE CITY
MYCOBACTERIUM TUBERCULOSIS			
M	52	1	ANNE ARUNDEL
F	30	1	BALTIMORE
M	49	1	BALTIMORE CITY
F	39	1	HOWARD
M	33	1	MONTGOMERY
M	43	1	MONTGOMERY
M	46	1	MONTGOMERY
M	68	1	MONTGOMERY
U	46	1	OUT OF STATE
F	30	1	OUT OF STATE
F	44	1	OUT OF STATE
F	49	1	OUT OF STATE
F	48	1	PRINCE GEORGE'S
MYCOBACTERIUM TUBERCULOSIS COMPLEX			
M	52	1	ANNE ARUNDEL
F	28	3	BALTIMORE
F	30	2	BALTIMORE
M	24	3	BALTIMORE
F	39	3	HOWARD
F	49	2	HOWARD
M	42	3	HOWARD
M	44	1	HOWARD
M	45	2	HOWARD
F	19	5	MONTGOMERY
F	85	4	MONTGOMERY
M	27	1	MONTGOMERY
M	40	4	MONTGOMERY
M	45	4	MONTGOMERY
M	46	1	MONTGOMERY
M	57	2	MONTGOMERY
M	68	6	MONTGOMERY
F	22	3	PRINCE GEORGE'S
F	38	2	PRINCE GEORGE'S
F	48	1	PRINCE GEORGE'S
M	48	1	PRINCE GEORGE'S
F	45	1	TALBOT
NON-PHOTOCHROMOGENIC MYCOBACTERIA			
M	37	1	BALTIMORE
M	86	1	PRINCE GEORGE'S
SCOTOCHROMOGENIC MYCOBACTERIA			
M	67	1	SAINT MARY'S
TOTAL	**107**		

MYCOBACTERIUM SUSCEPTIBILITY RESULTS

14 ISOLATES IDENTIFIED
1 DRUG RESISTANT STRAIN FOUND

#	JURISDICTION	DRUG(S)
1	BALTIMORE	STREPTOMYCIN

[A] TWO ISOLATES FROM THE SAME PATIENT
[B] PROBABLE FOR M. BOVIS
[C] MEETS CASE DEFINITION OF MULTI-DRUG TUBERCULOSIS (MDRTB)

Mycobacterium tuberculosis complex consists of:
M. tuberculosis
M. bovis
M. bovis, BCG
M. africanum
M. microti
M. canettii

PARASITOLOGY

GENUS/SPECIES	#	JURISDICTION
ENDOLIMAX NANA		
	2	MONTGOMERY
	1	PRINCE GEORGE'S
	2	MONTGOMERY
	1	PRINCE GEORGE'S
	3	MONTGOMERY
	1	PRINCE GEORGE'S
	1	HOWARD
	3	PRINCE GEORGE'S
ENTAMOEBA COLI		
	1	MONTGOMERY
	1	PRINCE GEORGE'S
	4	PRINCE GEORGE'S
ENTAMOEBA HARTMANNI		
	3	CARROLL
ENTEROBIUS VERMICULARIS		
	1	PRINCE GEORGE'S
GIARDIA LAMBLIA		
	3	PRINCE GEORGE'S
IODAMOEBA BÜTSCHLII		
	1	BALTIMORE
IXODES TEXANUS		
	1	BALTIMORE CITY
RHIPICEPHALUS SANGUINEUS		
	1	BALTIMORE CITY
TOTAL	**30**	

WATER MICROBIOLOGY

	# TESTED	# NON-COMPLIANT
COMMUNITY	2	0
NON-COMMUNITY	387	85
TOTAL	**389**	**85**

FOOD PROTECTION

	TOTALS
FOOD	
NUMBER OF SAMPLES	45
NOTABLE PATHOGENS:	
CAMPYLOBACTER SP.	2
CLOSTRIDIUM DIFFICILE	0
ENTEROCOCCUS	34
E. COLI	25
E. FAECALIS	0
LISTERIA SP.	0
MRSA	0
SALMONELLA SP.	5
VRE	0
CRABMEAT	
NUMBER OF SAMPLES	5
EXCEEDING STANDARDS[1]	1
NOTABLE PATHOGENS:	
LISTERIA INNOCUA	0
SHELLFISH	
NUMBER OF SAMPLES	0
EXCEEDING STANDARDS[2]	0
TOTAL STANDARDS EXCEEDED	0
SHELLFISH GROWING WATERS	
NUMBER OF SAMPLES	411
OTHER	
CLOSTRIDIUM BOTULINUM	0
TOTAL NUMBER OF SAMPLES	**461**

STANDARDS

[1]CRABMEAT FRESH
ESCHERICHIA COLI AT < 36 MPN/100 GRAMS
STANDARD PLATE COUNT AT < 100

[2]SHELLFISH
FECAL COLIFORMS AT < 230 MPN/100 GRAMS
STANDARD PLATE COUNT AT < 500,000 PER GRAM

VIRUS ISOLATION

ISOLATE	SEX	AGE	#	JURISDICTION
ADENOVIRUS				
	M	0	1	BALTIMORE CITY
HERPES SIMPLEX VIRUS TYPE 1				
	M	25	1	PRINCE GEORGE'S
	M	15	1	PRINCE GEORGE'S
	M	23	1	SOMERSET
HERPES SIMPLEX VIRUS TYPE 2				
	F	24	1	WICOMICO
PARAINFLUENZA VIRUS 1				
	M	0	1	BALTIMORE CITY
PARAINFLUENZA VIRUS 3				
	M	11	1	BALTIMORE CITY
	F	0	1	BALTIMORE CITY
TOTAL			**8**	

VIRAL POLYMERASE CHAIN REACTION (PCR)

ISOLATE SEX	AGE	#	JURISDICTION
HERPES SIMPLEX VIRUS TYPE 1			
F	18	1	ALLEGANY
M	28	1	BALTIMORE
U	23	1	BALTIMORE CITY
F	28	1	BALTIMORE CITY
M	21	1	BALTIMORE CITY
M	27	1	BALTIMORE CITY
M	40	1	BALTIMORE CITY
F	0	1	CALVERT
F	17	1	CALVERT
M	24	1	CHARLES
M	27	1	CHARLES
F	27	1	FREDERICK
F	29	1	FREDERICK
F	21	1	HARFORD
F	21	1	MONTGOMERY
F	20	1	PRINCE GEORGE'S
F	22	2	PRINCE GEORGE'S
F	23	1	PRINCE GEORGE'S
F	28	1	PRINCE GEORGE'S
M	48	1	TALBOT
F	20	1	WICOMICO
HERPES SIMPLEX VIRUS TYPE 2			
F	29	1	ANNE ARUNDEL
F	33	1	ANNE ARUNDEL
F	35	1	ANNE ARUNDEL
F	25	1	BALTIMORE
F	30	1	BALTIMORE
F	34	1	BALTIMORE
F	38	1	BALTIMORE
U	25	1	BALTIMORE CITY
U	30	1	BALTIMORE CITY
F	0	2	BALTIMORE CITY
F	16	1	BALTIMORE CITY
F	18	1	BALTIMORE CITY
F	20	1	BALTIMORE CITY
F	21	2	BALTIMORE CITY
F	24	2	BALTIMORE CITY
F	25	1	BALTIMORE CITY
F	26	2	BALTIMORE CITY
F	28	1	BALTIMORE CITY
F	36	1	BALTIMORE CITY
F	39	1	BALTIMORE CITY
F	52	1	BALTIMORE CITY
F	53	1	BALTIMORE CITY
M	0	1	BALTIMORE CITY
M	19	1	BALTIMORE CITY
M	24	1	BALTIMORE CITY
M	25	3	BALTIMORE CITY
M	29	2	BALTIMORE CITY
M	32	1	BALTIMORE CITY
M	33	1	BALTIMORE CITY
F	25	1	CALVERT
M	23	1	CALVERT
F	23	1	CHARLES
F	25	1	CHARLES
F	26	1	CHARLES
F	17	1	DORCHESTER
F	36	1	FREDERICK
F	45	1	GARRETT
M	20	1	HOWARD
F	23	1	KENT
F	24	1	MONTGOMERY
F	40	1	MONTGOMERY
M	34	1	MONTGOMERY
M	36	1	MONTGOMERY
F	18	1	PRINCE GEORGE'S
F	20	1	PRINCE GEORGE'S
F	22	1	PRINCE GEORGE'S
F	25	1	PRINCE GEORGE'S
F	26	1	PRINCE GEORGE'S
F	34	1	PRINCE GEORGE'S
F	47	1	PRINCE GEORGE'S
M	27	1	PRINCE GEORGE'S
M	39	1	PRINCE GEORGE'S
F	22	1	UNKNOWN
F	29	1	WORCESTER
TOTAL		**83**	

VIRAL HEPATITIS

ORGANISM	# SPECIMENS	# POSITIVES	JURISDICTION
HEPATITIS A			
	1	0	BALTIMORE
SUBTOTAL	**1**	**0**	
HEPATITIS B			
	60	0	ALLEGANY
	156	3	ANNE ARUNDEL
	57	1	BALTIMORE
	406	4	BALTIMORE CITY
	13	0	CALVERT
	16	0	CARROLL
	155	1	CECIL
	12	0	CHARLES
	42	0	FREDERICK
	14	0	GARRETT
	25	0	HARFORD
	15	0	HOWARD
	317	7	MONTGOMERY
	312	7	PRINCE GEORGE'S
	4	0	QUEEN ANNE'S
	8	0	TALBOT
	56	0	WASHINGTON
	57	0	WICOMICO
	1	0	WORCESTER
SUBTOTAL	**1,726**	**23**	
HEPATITIS C			
	55	8	ALLEGANY
	173	26	ANNE ARUNDEL
	60	5	BALTIMORE
	212	47	BALTIMORE CITY
	14	4	CALVERT
	18	0	CARROLL
	87	8	CECIL
	19	1	CHARLES
	44	1	FREDERICK
	18	0	GARRETT
	49	0	HARFORD
	15	0	HOWARD
	93	1	MONTGOMERY
	165	6	PRINCE GEORGE'S
	9	0	QUEEN ANNE'S
	1	0	SOMERSET
	8	0	TALBOT
	30	4	WASHINGTON
	7	0	WICOMICO
SUBTOTAL	**1,077**	**111**	
TOTALS	**2,804**	**134**	

RABIES

SOURCE	#	JURISDICTION
BAT	1	ANNE ARUNDEL
	3	BALTIMORE CITY
	1	CHARLES
	1	HOWARD
	2	MONTGOMERY
FOX	1	CARROLL
	1	MONTGOMERY
	1	PRINCE GEORGE'S
	1	QUEEN ANNE'S
	1	SAINT MARY'S
	1	WICOMICO
	1	WORCESTER
GROUND HOG	1	CHARLES
	1	FREDERICK
	1	MONTGOMERY
RACCOON	3	ANNE ARUNDEL
	1	DORCHESTER
	2	FREDERICK
	1	GARRETT
	3	MONTGOMERY
	1	SOMERSET
	1	TALBOT
SKUNK	1	CARROLL
	1	WICOMICO
TOTAL POSITIVES	**32**	
TOTAL SPECIMENS	**548**	

CHLAMYDIOPHILIA PSITTACI

(CHLAMYDIA) REPORTED QUARTERLY

4-1-09 TO 7-31-09 NONE REPORTED

VIRAL DISEASE ASSESSMENT - HIV

LYMPHOCYTE PHENOTYPING
(METHOD - FLOW CYTOMETRY)

DATES Quarterly comparison 2009-2010	% CD4 LYMPHOCYTES <14%	14%-28%	≥29%	TOTAL
4/01/10 - 7/31/10	150	416	306	**872**
4/01/09 - 7/31/09	150	435	280	**865**

BLOOD LEAD

I	<10	151
IIA	10-14	3
IIB	15-19	2
III	20-44	10
IV	45-69	0
V	>69	0
TOTAL		**166**

NEWBORN & CHILDHOOD SCREENING

PRESUMPTIVE POSITIVES

DISORDERS	#
PHENYLKETONURIA (PKU)	4
MAPLE SYRUP URINE DISEASE (MSUD)	4
HOMOCYSTINURIA	15
TYROSINEMIA	10
ARGININEMIA	0
CITRULLINEMIA	1
GALACTOSEMIA	3
BIOTINIDASE DEFICIENCY	6
HYPOTHYROIDISM	67
HEMOGLOBIN -DISEASE	21
HEMOGLOBIN -BENIGN	541
CONGENITAL ADRENAL HYPERPLASIA (CAH)	22
CYSTIC FIBROSIS	7
FATTY ACID OXIDATIONS	8
ORGANIC ACIDEMIAS	11
ACYLCARNITINE - BORDERLINE	10
ACYLCARNITINE - OTHERS	2

MONTHLY TOTALS

# OF SPECIMENS SCREENED	13,062
NUMBER OF TESTS	902,269
% UNSATISFACTORY SPECIMENS	1.9

2010 YEAR-TO-DATE CONFIRMED CASES

CONDITIONS	# CONFIRMED
MEDIUM CHAIN ACYL-CoA DEHYDROGENASE DEFICIENCY (MCAD)	2
SHORT CHAIN ACYL-CoA DEHYDROGENASE DEFICIENCY (SCAD)	6
ELEVATED FORMIMINOGLUTAMIC ACID (FIGLU)	1
3-METHYLCROTONYL-COA CARBOXYLASE DEFICIENCY (3-MCC)	3
GALACTOSE EPIMERASE DEFICIENCY	1
GALACTOSEMIA - VARIANT -DG	2
GALACTOSEMIA - UNKNOWN VARIANT	1
GLUTARIC ACIDURIA TYPE 1 (GA-1)	1
CONGENITAL ADRENAL HYPERPLASIA-SALT WASTING	2
CONGENITAL ADRENAL HYPERPLASIA-UNCLASSIFIED	1
HYPOTHYROIDISM - PRIMARY	13
OTHER HYPOTHYROIDISM	8
TBG DEFICIENCY	4
SICKLE CELL DISEASE -SS	30
SICKLE CELL DISEASE -SC	18
SICKLE CELL DISEASE -S BETA THALASSEMIA	3
SICKLE CELL DISEASE-SV	1
HEMOGLOBIN VARIANT	1
CYSTIC FIBROSIS	3
CFTR-RELATED METABOLIC SYNDROME (CRMS)	1
TRANSIENT TYROSINEMIA	5

ENVIRONMENTAL CHEMISTRY

SAMPLE TYPES	# NON-COMPLIANT	# TESTED
ASBESTOS		
AIR	0	0
BULK	4	10
AIR QUALITY		
$PM_{2.5}$	0	828
RADIATION		
AIR/CHARCOAL FILTERS	0	74
MILK	0	1
WIPES	0	129
RAW WATER	0	6
VEGETATION	0	0
OTHER	0	0
DRINKING WATER		
METALS		
COMMUNITY	8	15
NON-COMMUNITY	6	7
PRIVATE WELLS	27	139
PESTICIDES & PCBs		
COMMUNITY	0	109
NON-COMMUNITY	0	20
PRIVATE WELLS	0	9
VOLATILE ORGANIC COMPOUNDS		
COMMUNITY	2	369
NON-COMMUNITY	0	94
PRIVATE WELLS	0	33
RADIATION		
COMMUNITY	0	17
NON-COMMUNITY	0	0
PRIVATE WELLS	0	18
INORGANICS		
COMMUNITY	1	51
NON-COMMUNITY	1	93
PRIVATE WELLS	0	135
FOOD CHEMISTRY		
SUSPECTED TAMPERING	0	3
MICROSCOPIC FILTH	0	8
LABELING	0	0
SURVEILLANCE	0	1
CHEMICAL CONTAMINATION	0	0
TOTAL	**49**	**2,169**

VIRAL LOAD SPECIMENS

HIV-1 RNA COPIES/ML	$<10^3$	10^3—10^4	10^4—10^5	$>10^5$	TOTALS
ALLEGANY	10	3	1	0	**14**
BALTIMORE CITY	1	0	0	0	**1**
CARROLL	1	0	0	0	**1**
FREDERICK	3	0	2	0	**5**
MONTGOMERY	82	8	10	0	**100**
PRINCE GEORGE'S	114	15	16	4	**149**
WASHINGTON	5	0	0	0	**5**
WICOMICO	1	0	1	1	**3**
SUBTOTALS	217	26	30	5	**278**
DEPT. OF CORRECTIONS	20	4	1	3	**28**
TOTALS	**237**	**30**	**31**	**8**	**306**

HIV ANTIBODY SCREENING

SUBMITTER	TOTAL SPECIMENS	# EIA POSITIVE	% EIA POSITIVE	# WB POSITIVE	% WB POSITIVE
CORRECTIONAL INSTITUTIONS	221	1	0.45%	1	100.00%
FAMILY PLANNING (NON-GOVERNMENT)	123	0	0.00%	0	0.00%
HEALTH CENTERS (NON-GOVERNMENT)	373	38	10.19%	35	92.11%
HLTH DEPT, NON-STD, FAMILY PLAN	411	1	0.24%	0	0.00%
HLTH DEPT, NON-STD, OB/GYN	102	0	0.00%	0	0.00%
HLTH DEPT, NON-STD, OTHER	654	53	8.10%	49	92.45%
HLTH DEPT, STD CLINICS	988	11	1.11%	9	81.82%
HOSPITAL, OTHER	109	14	12.84%	10	71.43%
HOSPITAL, PUBLIC	29	0	0.00%	0	0.00%
JUVENILE SERVICES	84	1	1.19%	1	100.00%
LABORATORIES (NON-HOSPITAL)	423	24	5.67%	7	29.17%
PEDIATRIC - CHILD HEALTH	8	0	0.00%	0	0.00%
PRIVATE PHYSICIANS	2	1	50.00%	1	100.00%
PRIVATE STUDENT HEALTH CNTRS	10	0	0.00%	0	0.00%
PUBLIC STUDENT HEALTH CENTERS	82	2	2.44%	2	100.00%
TOTALS	**3,619**	**146**	**4.03%**	**115**	**78.77%**

MAILING LABEL

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