

July 14, 2009

Participant  
Centers for Disease Control and Prevention (CDC)  
**Drug Susceptibility Testing (DST) of *Mycobacterium tuberculosis* and Nontuberculous  
Mycobacteria (NTM) Performance Evaluation Program**

Subject: Analyses of Participant Laboratory Results for the April 2009 Shipment

Dear Participant:

Enclosed are analyses of laboratory test results reported to the Centers for Disease Control and Prevention by participant laboratories for strains of *Mycobacterium tuberculosis* complex shipped in April 2009. Participant laboratories (102) received four *M. tuberculosis* complex strains only. Testing results were received and analyzed from 94 of 102 (92.2%) laboratories participating in this shipment. Of the laboratories submitting results, 63 (67.0%) reported them via the online data entry system.

The enclosed aggregate report is prepared in a format that will allow laboratories to compare their results with those obtained by other participants for the same strain using the same method, drug, and concentration. We encourage you to circulate this report to personnel who are involved with drug susceptibility testing, reporting, or interpreting for *M. tuberculosis*.

This shipment did not contain an NTM strain for performance evaluation. However, laboratories performing DST on NTM are encouraged to follow the consensus report by the American Thoracic Society and the Clinical and Laboratory Standards Institute (CLSI) approved standard which provide recommendations for NTM test methods and drugs that have clinical relevance.

If you have any comments or suggestions on the results in this report or have questions regarding the changes in this program, you may call me at (404) 498-2295.

Sincerely yours,



Pawan Angra, MS, DCPSA, PhD  
Project Officer  
1600 Clifton Road, N.E.  
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Enclosures

## Analyses of April 2009 *M. tuberculosis* Drug Susceptibility Test Results Reported by Participating Laboratories

This report analyzes the laboratory test results reported to the Centers for Disease Control and Prevention (CDC) by participant laboratories for the four *Mycobacterium tuberculosis* complex isolates shipped in April 2009. Participant laboratories received four *M. tuberculosis* complex strains only. Testing results were received and analyzed from 94 of 102 (92.2%) laboratories participating in this shipment. Of the laboratories submitting results, 63 (67.0%) reported via the online data entry system.

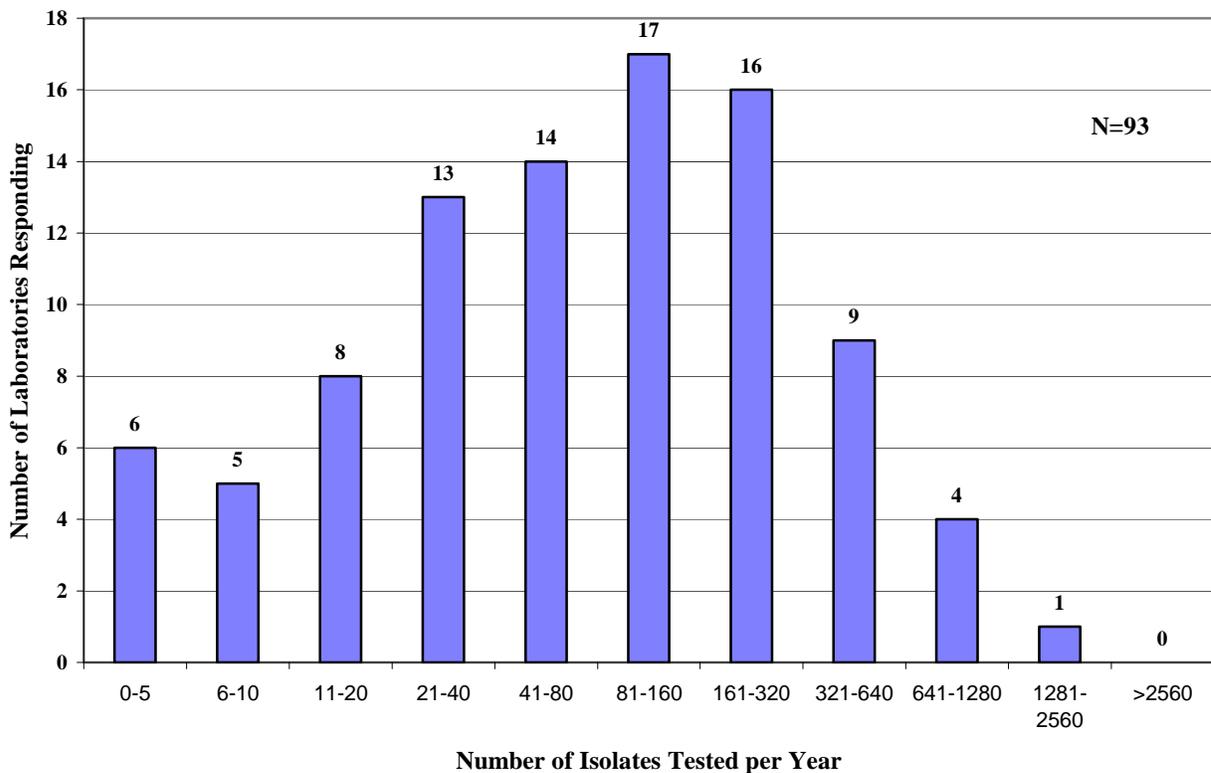
### Descriptive Information on Participant Laboratories

Laboratory classifications reported by the 94 participants are:

- 60 (63.8%) health departments,
- 24 (25.5%) hospitals,
- 9 (9.6%) independent laboratories, and
- 1 (1.1%) other type of laboratories.

Figure 1 shows the distribution of the annual volume of *M. tuberculosis* susceptibility testing performed by participants. The numbers on top of the bars indicate the number of laboratories within each group. Among the participant laboratories 98.9% (93/94) reported their annual volume.

**Figure 1: Distribution of the Annual Volume of *M. tuberculosis* Isolates Tested for Drug Susceptibility by Participating Laboratories in Calendar Year 2008.**



According to the annual volume of testing reported, some laboratories performed 0-5 drug susceptibility tests per month. Laboratories performing these low testing volumes may want to consider referring drug susceptibility tests to other facilities.

## **Biosafety Levels of Participant Laboratories**

The biosafety levels (BSL) reported by participant laboratories for handling *M. tuberculosis* were:

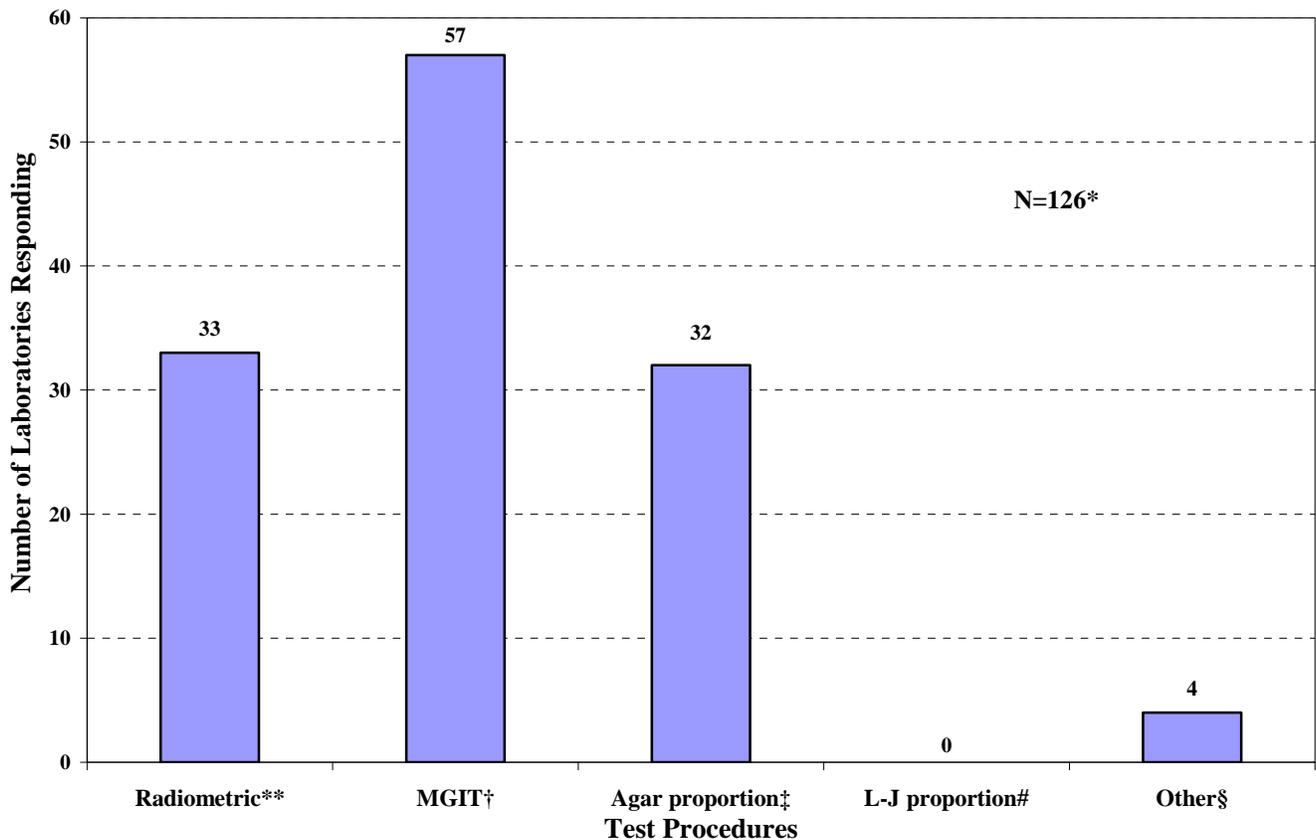
- BSL-3, 58 participants,
- BSL-2 facilities with level 3 containment practices, 30 participants,
- BSL-2, 5 participants.

All laboratories are strongly encouraged to consult the CDC/NIH manual, Biosafety in Microbiological and Biomedical Laboratories (5th Edition), which can be accessed on the web at <http://www.cdc.gov/od/ohs/biosfty/bmb15/bmb15toc.htm> for recommendations and to determine their correct biosafety level.

## **Laboratory Test Procedures**

Figure 2 shows the number of laboratories by the type of procedure used for drug susceptibility testing.

**Figure 2: Procedures Used by the Participating Laboratories for *M. tuberculosis* Drug Susceptibility Testing**



\* Some participants reported more than one test method.

\*\* Radiometric is BACTEC 460TB

† MGIT, Mycobacteria Growth Indicator Tube (BACTEC MGIT 960)

‡ Agar proportion using Middlebrook 7H10 or 7H11 medium.

# Lowenstein-Jensen proportion method

§ Other methods listed were microtiter, Bact/ALERT, and VersaTREK ESP

Thirty laboratories reported using 2 methods: 12 laboratories reported using agar proportion and radiometric methods; 15 laboratories reported agar proportion and MGIT methods; 3 laboratories reported using radiometric and MGIT methods.

One laboratory reported using 3 methods: agar proportion, radiometric, and MGIT methods.

### **M. tuberculosis Complex Strains Test Results:**

To facilitate comparison among laboratories, the aggregate test results are provided in Tables 1.0 through 1.3 at the end of this document, representing strains K, L, M, and N. The tables for the *M. tuberculosis* complex strains K, L, M, and N include results for the radiometric (BACTEC), agar proportion (AP), MGIT, and other methods at each drug concentration.

In the tables, the concentrations recommended by CDC and the Clinical and Laboratory Standards Institute (CLSI)<sup>1</sup> for the primary [isoniazid (INH), rifampin (RIF), pyrazinamide (PZA), and ethambutol (EMB)] and secondary [streptomycin (SM), ethionamide (THA), kanamycin (KM), capreomycin (CM), and p-amino-salicylic acid (PAS)] antituberculosis drugs are highlighted for the agar proportion, radiometric, and MGIT methods. Participants should note that these recommended combinations reflect the critical concentrations of antituberculosis drugs in 7H10 agar and those concentrations for the BACTEC method that directly correlate with the critical concentrations in the conventional method. When two concentrations are highlighted, such as for isoniazid and ethambutol, the lower concentration is the critical concentration that should always be included to determine whether the *M. tuberculosis* isolate is resistant.

**Strain K, *M. tuberculosis*** – Fully susceptible to first line drugs; Fluoroquinolone resistant.

Among the participant laboratories no drug resistance was reported for isoniazid, rifampin, and ethambutol and streptomycin.

Among the participant laboratories pyrazinamide resistance was reported by 2% (1/51) using MGIT method at 100 µg/ml.

Ofloxacin is the class representative for fluoroquinolones. The CLSI M24-A guidelines, recommend testing at 2.0 µg/ml by AP method. The proposed equivalent concentration by BACTEC and MGIT methods is 2.0 µg/ml<sup>2,3</sup>. Among the participant laboratories ofloxacin resistance was reported by 100% using agar proportion (13/13) and BACTEC (2/2) methods.

**Strain L, *M. tuberculosis*** – INH resistant at 0.2 and 1.0 µg/ml; Ethambutol resistant at 5.0 and 10.0 µg/ml.

Isoniazid has two recommended concentrations for the AP method (0.2 µg/ml and 1.0 µg/ml) and equivalent concentrations for BACTEC 460TB and MGIT (0.1 µg/ml and 0.4 µg/ml, respectively). Among the participant laboratories INH resistance was reported by 100% (26/26) at 0.2 µg/ml and 100% (28/28) at 1.0 µg/ml by agar proportion method. For participants using BACTEC, 100% (26/26) at 0.1 µg/ml and 100% (11/11) at 0.4 µg/ml have reported resistance. For participants using MGIT method 98.2% (55/56) at 0.1 µg/ml and 100% (29/29) at 0.4 µg/ml reported resistance.

Ethambutol susceptibility testing has always been difficult for many reasons including narrow critical breakpoint for drug resistance and the MIC of susceptible strains<sup>4</sup>. Among the participant laboratories, ethambutol resistance was reported by 79.2% (19/24) at 5 µg/ml and no resistance was reported (0/11) at 10 µg/ml using agar proportion method. Among the laboratories using BACTEC, resistance was reported by 95.8% (23/24) at 2.5 µg/ml and only 20.0% (1/5) at 7.5 µg/ml. Among the participant laboratories, 35.7% (20/56) reported resistance at 5.0 µg/ml and no resistance (0/1) at 7.5 µg/ml using MGIT method.

**Strain M, *M. tuberculosis***- Rifampin resistant; Streptomycin resistant at 2.0 and 10.0 µg/ml.

Rifampin is a first line drug and has recommended concentration (1.0 µg/ml) for agar proportion method and equivalent concentration (2.0 µg/ml) for BACTEC and (1.0 µg/ml) for MGIT methods. Among the participant laboratories, resistance was reported by 100% (27/27) at 1.0 µg/ml using agar proportion method. Resistance was reported by 100% (27/27) of laboratories at 2.0 µg/ml by BACTEC and 100% (56/56) of laboratories using MGIT at 1.0 µg/ml.

Among the participant laboratories streptomycin resistance was reported 100% (27/27) at 2.0 µg/ml and 100% (23/23) at 10 µg/ml by agar proportion method. Among the participant laboratories resistance was reported by 100% (27/27) at 2.0 µg/ml and 100% (5/5) at 6.0 µg/ml by BACTEC method. Participant laboratories using MGIT method reported 100.0% (40/40) resistance at 1.0 µg/ml and 100% (13/13) resistance at 0.4 µg/ml.

**Strain N, *M. tuberculosis*** – Streptomycin resistant at 2.0 and 10.0 µg/ml.

Among the participant laboratories streptomycin resistance was reported 100% (27/27) at 2.0 µg/ml and 100% (24/24) at 10 µg/ml by agar proportion method. Among the participant laboratories resistance was reported by 100% (27/27) at 2.0 µg/ml and 100% (5/5) at 6.0 µg/ml by BACTEC method. Participant laboratories using MGIT method reported 100.0% (40/40) resistance at 1.0 µg/ml and 100% (13/13) resistance at 0.4 µg/ml.

*Note:* Providing test results for all drugs that are reported to CDC by participant laboratories should not be construed as a recommendation or endorsement for testing particular drug concentrations with patient isolates of the *M. tuberculosis* complex. It is assumed that some of the drugs are being tested for research purposes or potential use in the few referral institutions that may treat patients with *M. tuberculosis* isolates resistant to almost all standard drugs. Laboratories should not add drugs to their testing regimen without consulting physicians having expertise in treating multidrug-resistant tuberculosis. Laboratories may contact their local TB control program for referrals of physicians with experience and expertise in treating multidrug-resistant tuberculosis.

## Tables

The test results are listed in the appropriate (susceptible or resistant) columns with a corresponding total number of tests (Sum) column provided as a denominator for determining the level of consensus. This report contains all results reported by participating laboratories, including many drug concentrations with only one result.

The CDC and CLSI recommendations reflect the critical concentrations of anti-tuberculosis drugs in 7H10 agar and those concentrations for the BACTEC 460TB method that directly correlate with the critical concentrations in the conventional method<sup>4-7</sup>. These critical values are highlighted. When two concentrations are highlighted, such as for isoniazid and ethambutol, the lower value is the critical concentration which should always be included for determining whether the *M. tuberculosis* isolate is resistant.

Participants should note that the CLSI approved standard “Susceptibility Testing of Mycobacteria, Nocardiae, and Other Aerobic Actinomycetes,” M24-A (ISBN 1-56238-500-3) CLSI, 940 West Valley Road, Suite 1400, Wayne, Pennsylvania 19087-1898, USA, 2003, recommends testing streptomycin as a secondary drug and also adds ofloxacin and rifabutin to the list of recommended secondary drugs for isolates of *M. tuberculosis* complex.

Concentrations are listed in micrograms per milliliter, µg/ml.

### Acknowledgments

Special thanks to the following persons for reviewing this report: Barbara Brown-Elliott, M.S., University of Texas at Tyler, TX; Beverly Metchock, Dr. P.H; Roberta Carey, Ph.D.; Pamela H. Robinson, CDC/Atlanta; Wendy Gross, M.S., TB Reference Laboratory, West Haven, CT.

**Table 1.0 Participant Results for culture K, *M. tuberculosis*, fully susceptible to first line drugs; Fluoroquinolone resistant.**

DRUG	Conc	Test Method											
		AP Results			BACTEC Results			MGIT Results			Other Tests Results		
		S	R	Sum	S	R	Sum	S	R	Sum	S	R	Sum
Isoniazid	0.10				26		26	56		56	4		4
Isoniazid	0.20	22		22	2		2	1		1			
Isoniazid	0.40				8		8	21		21	4		4
Isoniazid	1.00	23		23	1		1	1		1			
Isoniazid	5.00	5		5									
Rifampin	1.00	22		22	4		4	56		56	4		4
Rifampin	2.00				26		26	1		1			
Rifampin	5.00	3		3									
Pyrazinamide	100.00				23		23	50	1	51			
Pyrazinamide	300.00				1		1				4		4
Ethambutol	2.50				24		24	1		1			
Ethambutol	5.00	20		20	3		3	55		55	4		4
Ethambutol	7.50	1		1	5		5	1		1			
Ethambutol	8.00										4		4
Ethambutol	10.00	9		9									
Ethambutol	25.00	1		1									
Streptomycin	1.00	1		1				40		40			
Streptomycin	2.00	22		22	27		27	1		1			
Streptomycin	4.00	1		1				9		9			
Streptomycin	6.00				4		4						
Streptomycin	10.00	20		20									
Streptomycin	50.00	1		1									
Ethionamide	1.00	1		1									
Ethionamide	5.00	16		16	1		1	1		1			
Ethionamide	10.00	3		3									
Kanamycin	5.00	9		9									
Kanamycin	6.00	8		8									
Capreomycin	3.00							1		1			
Capreomycin	5.00				1		1						
Capreomycin	10.00	17		17									
Cycloserine	25.00	1		1									
Cycloserine	30.00	7		7									
Cycloserine	50.00	1		1									
Cycloserine	60.00	1		1									
p-Aminosalicylic acid	2.00	13		13									
p-Aminosalicylic acid	4.00				1		1						
p-Aminosalicylic acid	8.00	1		1									
p-Aminosalicylic acid	10.00	3		3									
Amikacin	1.50							1		1			
Amikacin	2.00	1		1	1		1						
Amikacin	2.50	1		1									
Amikacin	4.00	2		2									
Amikacin	5.00	1		1	1		1						
Amikacin	6.00	5		5									
Amikacin	8.00				1		1						
Amikacin	12.00	2		2									

**Table 1.0 Participant Results for culture K, *M. tuberculosis*, fully susceptible to first line drugs; Fluoroquinolone resistant.**

DRUG	Conc	Test Method														
		AP Results			BACTEC Results			MGIT Results			Other Tests Results					
		S	R	Sum	S	R	Sum	S	R	Sum	S	R	Sum			
Ofloxacin	1.00		1	1												
Ofloxacin	2.00		13	13		2	2									
Ofloxacin	4.00		1	1		1	1									
Ofloxacin	8.00				1		1									
Ofloxacin	10.00		1	1												
Clofazimine	0.06					1	1									
Clofazimine	0.12					1	1									
Clofazimine	0.25				1		1									
Clofazimine	1.00	2		2												
Rifabutin	0.50	3		3												
Rifabutin	1.00	2		2												
Rifabutin	2.00	4		4												
Ciprofloxacin	1.00		1	1												
Ciprofloxacin	2.00	1	5	6		2	2									
Ciprofloxacin	4.00					1	1									
Levofloxacin	1.50								1	1						
Levofloxacin	2.00					1	1									
Levofloxacin	8.00					1	1									
Moxifloxacin	1.00		1	1												
Moxifloxacin	2.50	1		1												

**Table 1.1 Participant Results for Culture L, *M. tuberculosis*, resistant to isoniazid at 0.2 and 1.0 µg/ml and to ethambutol at 5.0 and 10.0 µg/ml.**

DRUG	Conc	Test Method											
		AP Results			BACTEC Results			MGIT Results			Other Tests Results		
		S	R	Sum	S	R	Sum	S	R	Sum	S	R	Sum
Isoniazid	0.10				26	26		1	55	56		4	4
Isoniazid	0.20		26	26	3	3		1	1				
Isoniazid	0.40				11	11		29	29		4	4	
Isoniazid	1.00		28	28	2	2		1	1				
Isoniazid	2.00				2	2							
Isoniazid	5.00		5	5	1	1							
Rifampin	1.00	27		27	4	4		56	56		4	4	
Rifampin	2.00				26	26		1	1				
Rifampin	5.00	4		4									
Pyrazinamide	100.00				23	23		49	2	51			
Pyrazinamide	300.00				1	1					4	4	
Ethambutol	1.50	1		1									
Ethambutol	2.50				1	23	24	1		1			
Ethambutol	5.00	5	19	24		4	4	36	20	56	3	1	4
Ethambutol	7.50				4	1	5	1		1			
Ethambutol	8.00										4		4
Ethambutol	10.00	11		11									
Ethambutol	10.00				1		1						
Ethambutol	25.00		1	1									
Streptomycin	1.00	1		1				40	40				
Streptomycin	2.00	27		27	27	27		1	1				
Streptomycin	4.00	1		1				9	9				
Streptomycin	6.00				4	4							
Streptomycin	10.00	22		22									
Streptomycin	50.00	1		1									
Ethionamide	1.00	1		1									
Ethionamide	1.25					1	1						
Ethionamide	2.50					2	2						
Ethionamide	5.00	12	6	18	1	2	3	1		1			
Ethionamide	10.00	3		3									
Kanamycin	2.50					1	1						
Kanamycin	5.00		9	9		2	2						
Kanamycin	6.00	1	11	12									
Kanamycin	10.00					1	1						
Capreomycin	1.25					1	1						
Capreomycin	2.50					2	2						
Capreomycin	3.00							1		1			
Capreomycin	5.00				1	4	5						
Capreomycin	10.00	2	16	18	1		1						
Ciprofloxacin	1.00	2		2	1		1						
Ciprofloxacin	2.00	8		8	2		2						
Ciprofloxacin	2.50				1		1						
Ciprofloxacin	4.00				1		1						

**Table 1.1 Participant Results for Culture L, *M. tuberculosis*, resistant to isoniazid at 0.2 and 1.0 µg/ml and to ethambutol at 5.0 and 10.0 µg/ml.**

DRUG	Conc	Test Method														
		AP Results			BACTEC Results			MGIT Results			Other Tests Results					
		S	R	Sum	S	R	Sum	S	R	Sum	S	R	Sum			
Cycloserine	25.00	1		1												
Cycloserine	30.00	9		9												
Cycloserine	50.00	1		1												
Cycloserine	60.00	2		2												
p-Aminosalicylic acid	2.00	17		17												
p-Aminosalicylic acid	4.00				1		1									
p-Aminosalicylic acid	8.00	1		1												
p-Aminosalicylic acid	10.00	4		4												
Amikacin	1.50								1		1					
Amikacin	2.00		1	1			1	1								
Amikacin	2.50						1	1								
Amikacin	4.00		2	2												
Amikacin	5.00		1	1			1	1								
Amikacin	6.00		5	5												
Amikacin	8.00						1	1								
Amikacin	12.00		2	2												
Amikacin	20.00		1	1												
Ofloxacin	1.00	2		2	1		1									
Ofloxacin	1.25				1		1									
Ofloxacin	2.00	13		13	5		5									
Ofloxacin	4.00	1		1	1		1									
Ofloxacin	8.00						1	1								
Clofazimine	0.06				1		1									
Clofazimine	0.12				1		1									
Clofazimine	0.25				1		1									
Clofazimine	0.50				2		2									
Clofazimine	1.00	2		2												
Rifabutin	0.50	3		3	1		1									
Rifabutin	1.00	2		2												
Rifabutin	2.00	4		4												
Levofloxacin	1.50								1		1					
Levofloxacin	2.00				2	1	3									
Levofloxacin	8.00					1	1									
Moxifloxacin	0.16	1		1												
Moxifloxacin	1.00	1		1												

**Table 1.2 Participant Results for Culture M, *M. tuberculosis*, resistant to rifampin at 1.0 µg/ml and to streptomycin at 2.0 and 10.0 µg/ml.**

DRUG	Conc	Test Method											
		AP Results			BACTEC Results			MGIT Results			Other Tests Results		
		S	R	Sum	S	R	Sum	S	R	Sum	S	R	Sum
Isoniazid	0.10				26		26	56		56	4		4
Isoniazid	0.20	26		26	2		2	1		1			
Isoniazid	0.40				10		10	21		21	4		4
Isoniazid	1.00	26		26	1		1	1		1			
Isoniazid	5.00	4		4									
Rifampin	1.00		27	27		4	4		56	56		4	4
Rifampin	2.00					27	27		1	1			
Rifampin	5.00		3	3		2	2						
Rifampin	10.00					1	1						
Pyrazinamide	100.00				21	2	23	51		51			
Pyrazinamide	300.00				1		1				3		3
Ethambutol	1.50	1		1									
Ethambutol	2.50				23	1	24	1		1			
Ethambutol	5.00	24		24	3		3	56		56	4		4
Ethambutol	7.50	1		1	5		5	1		1			
Ethambutol	8.00										4		4
Ethambutol	10.00	11		11									
Streptomycin	1.00								40	40			
Streptomycin	2.00		27	27		27	27		1	1			
Streptomycin	4.00		1	1		1	1		13	13			
Streptomycin	6.00					5	5						
Streptomycin	10.00		23	23		1	1						
Ethionamide	1.25					1	1						
Ethionamide	2.50					2	2						
Ethionamide	5.00	4	16	20		3	3		1	1			
Ethionamide	10.00	2	1	3									
Kanamycin	2.50					1	1						
Kanamycin	5.00	2	7	9		2	2						
Kanamycin	6.00	4	8	12									
Kanamycin	10.00					1	1						
Capreomycin	1.25				1		1						
Capreomycin	2.50				2		2						
Capreomycin	3.00							1		1			
Capreomycin	5.00				4		4						
Capreomycin	10.00	18		18									
Cycloserine	25.00	1		1									
Cycloserine	30.00	9		9									
Cycloserine	50.00	1		1									
Cycloserine	60.00	2		2									
p-Aminosalicylic acid	2.00	17		17									
p-Aminosalicylic acid	4.00				1		1						
p-Aminosalicylic acid	8.00	1		1									
p-Aminosalicylic acid	10.00	4		4									

**Table 1.2 Participant Results for Culture M, *M. tuberculosis*, resistant to rifampin at 1.0 µg/ml and to streptomycin at 2.0 and 10.0 µg/ml.**

DRUG	Conc	Test Method												
		AP Results			BACTEC Results			MGIT Results			Other Tests Results			
		S	R	Sum	S	R	Sum	S	R	Sum	S	R	Sum	
Amikacin	1.50								1		1			
Amikacin	2.00	1		1	1		1							
Amikacin	2.50	1		1	1		1							
Amikacin	4.00	2		2										
Amikacin	5.00	1		1	1		1							
Amikacin	6.00	5		5										
Amikacin	8.00				1		1							
Amikacin	12.00	2		2										
Ofloxacin	1.00	2		2	1		1							
Ofloxacin	1.25				1		1							
Ofloxacin	2.00	13		13	5		5							
Ofloxacin	4.00	1		1	1		1							
Ofloxacin	4.00													
Ofloxacin	8.00				1		1							
Clarithromycin	3.00		1	1										
Clofazimine	0.06					1	1							
Clofazimine	0.12				1		1							
Clofazimine	0.25				1		1							
Clofazimine	0.50				2		2							
Clofazimine	1.00	2		2										
Rifabutin	0.05					1	1							
Rifabutin	0.25					1	1							
Rifabutin	0.50		3	3		2	2							
Rifabutin	1.00		2	2										
Rifabutin	2.00		4	4										
Ciprofloxacin	1.00	2		2	1		1							
Ciprofloxacin	1.25				1		1							
Ciprofloxacin	2.00	8		8	2		2							
Ciprofloxacin	2.50				2		2							
Ciprofloxacin	4.00				1		1							
Levofloxacin	1.50							1		1				
Levofloxacin	2.00				3		3							
Levofloxacin	8.00				1		1							
Moxifloxacin	0.16	1		1										
Moxifloxacin	1.00	1		1										
Azithromycin	3.00		1	1										

**Table 1.3 Participant Results for Culture N, *M. tuberculosis*, resistant to streptomycin at 2.0 and 10.0 µg/ml.**

DRUG	Conc	Test Method											
		AP Results			BACTEC Results			MGIT Results			Other Tests Results		
		S	R	Sum	S	R	Sum	S	R	Sum	S	R	Sum
Isoniazid	0.10				26		26	55	1	56	4		4
Isoniazid	0.20	26		26	2		2	1		1			
Isoniazid	0.40				8		8	20	1	21	4		4
Isoniazid	1.00	27		27	1		1	1		1			
Isoniazid	5.00	5		5									
Rifampin	1.00	27		27	4		4	56		56	4		4
Rifampin	2.00				26		26	1		1			
Rifampin	5.00	4		4									
Pyrazinamide	100.00				23		23	41	8	49			
Pyrazinamide	300.00				1		1				3		3
Ethambutol	1.50	1		1									
Ethambutol	2.50				23		23	1		1			
Ethambutol	5.00	23		23	3		3	54	2	56	4		4
Ethambutol	7.50	1		1	5		5	1		1			
Ethambutol	8.00										4		4
Ethambutol	10.00	11		11									
Ethambutol	25.00	1		1									
Streptomycin	1.00							40		40			
Streptomycin	2.00		27	27		27	27	1		1			
Streptomycin	4.00		1	1		1	1	13		13			
Streptomycin	6.00					5	5						
Streptomycin	10.00		24	24		1	1						
Streptomycin	50.00		1	1									
Ethionamide	5.00	15	4	19	1		1	1		1			
Ethionamide	10.00	3		3									
Kanamycin	5.00	9		9									
Kanamycin	6.00	12		12									
Capreomycin	3.00							1		1			
Capreomycin	5.00				1		1						
Capreomycin	10.00	18		18									
Cycloserine	25.00	1		1									
Cycloserine	30.00	8		8									
Cycloserine	50.00	1		1									
Cycloserine	60.00	1		1									
p-Aminosalicylic acid	2.00	16		16									
p-Aminosalicylic acid	4.00				1		1						
p-Aminosalicylic acid	8.00	1		1									
p-Aminosalicylic acid	10.00	3		3									
Amikacin	1.50							1		1			
Amikacin	2.00	1		1	1		1						
Amikacin	2.50	1		1									
Amikacin	4.00	2		2									
Amikacin	5.00	1		1	1		1						
Amikacin	6.00	5		5									
Amikacin	8.00				1		1						
Amikacin	12.00	2		2									

**Table 1.3 Participant Results for Culture N, *M. tuberculosis*, resistant to streptomycin at 2.0 and 10.0 µg/ml.**

DRUG	Conc	Test Method														
		AP Results			BACTEC Results			MGIT Results			Other Tests Results					
		S	R	Sum	S	R	Sum	S	R	Sum	S	R	Sum			
Ofloxacin	1.00	2		2												
Ofloxacin	2.00	13		13	2		2									
Ofloxacin	4.00	1		1	1		1									
Ofloxacin	8.00				1		1									
Clofazimine	0.06					1	1									
Clofazimine	0.12				1		1									
Clofazimine	0.25				1		1									
Clofazimine	1.00	2		2												
Rifabutin	0.50	3		3												
Rifabutin	1.00	2		2												
Rifabutin	2.00	4		4												
Ciprofloxacin	1.00	2		2												
Ciprofloxacin	2.00	8		8	2		2									
Ciprofloxacin	4.00				1		1									
Levofloxacin	1.50							1		1						
Levofloxacin	2.00				1		1									
Levofloxacin	8.00				1		1									
Moxifloxacin	0.16	1		1												
Moxifloxacin	1.00	1		1												

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