2022 Mycobacteriology Laboratory Testing Summary

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Mycobacteriology, Diagnostic Services, Shared Health

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Purpose

This summary presents information on specimens tested for *Mycobacterium* sp. by the Mycobacteriology laboratory, Diagnostic Services, Shared Health from January 1, 2022 to December 31, 2022. This summary aims to describe the laboratory testing volumes, test performance criteria and result turnaround times. Turnaround times are evaluated on a 7 day a week, 24 hour a day schedule; however, the Mycobacteriology laboratory is only operational Monday to Friday, 0745 to 1600.

Testing Overview

All patient samples in Manitoba for which acid-fast bacilli (AFB)/Mycobacteria testing is requested are sent to the Health Sciences Centre for processing by the Mycobacteriology laboratory. Every AFB sample (except CSF, blood and bone marrow) is processed by concentration and decontamination, evaluated by microscopy for the presence of AFB and is inoculated into liquid media and onto solid media for culture. The standard inoculated media include BD BACTEC™ mycobacterial growth indicator tubes (MGIT™) and Löwenstein–Jensen (LJ) agar. MGIT™ tubes are continuously monitored for growth on the BD BACTEC™ MGIT™ automated mycobacterial detection system and LJ agar slants are inspected manually for growth. CSF samples are evaluated for AFB by direct culture of patient samples (i.e., without concentration and decontamination) using MGIT™ tubes and LJ agar slants. Blood and bone marrow samples are inoculated into BD BACTEC™ Myco/F Lytic culture tubes and evaluated for growth on the continuous monitoring BD BACTEC™ FX blood culture system.

AFB smears are reported semi-quantitatively (Negative or 1+ to 4+ AFB) following sample processing. The majority of mycobacterial cultures are incubated for 7 weeks. As soon as growth is detected in the MGIT™ tube or on the LJ agar slant, organism identification is attempted. Positive *M. tuberculosis* complex isolates are identified using an antigen-based assay (Bioline™ TB Ag MPT64). Nontuberculous mycobacteria are identified by MALDI-ToF.

M. tuberculosis complex are routinely referred to the National Reference Centre for Mycobacteriology-National Microbiology Laboratory (NRCM-NML) for antimicrobial susceptibility testing and mycobacterial interspersed repetitive unit (MIRU) typing. Antimicrobial susceptibility testing is performed using growth-based phenotypic methods, providing susceptible and resistant results, and by molecular methods, which identify mutations that are associated with antimicrobial resistance and predict susceptible and resistant phenotypic results. Antimicrobial susceptibility testing for nontuberculous mycobacteria isolates may be requested by consultation with the on-call Shared Health Microbiologist.

All microscopy smear-positive AFB samples receive a nucleic acid amplification test (NAAT), excluding blood, stool, mucosal and skin samples for which the NAAT is not validated. AFB smear-negative samples require a microbiologist consult if a NAAT is requested. The in-house NAAT detects *M. tuberculosis* and *Mycobacterium* sp. DNA.

Sample collection instructions are detailed in the Laboratory Information Manual: https://apps.sbgh.mb.ca/labmanual/test/findTestPrepare

2022 Testing Results

The Mycobacteriology laboratory, Diagnostic Services, Shared Health received 12952 samples for AFB testing from January 1, 2022 to December 31, 2022. The number of samples by specimen type was as follows: 95 blood cultures, 32 bone marrow samples, 240 cutaneous samples, 105 stool samples, 2101 fluid samples, 1070 tissue samples and 9309 respiratory samples. The average transport time from collection to receipt in the laboratory was 1.7 days, with 57.8% and 73.6% of samples received within 1 and 2 days, respectively. The average turnaround time from sample receipt to AFB smear report was 0.9 days, with 69.1% and 83.6% completed within 1 and 2 days, respectively.

Of the 12952 samples, 794 were positive cultures collected from 455 patients. 315 of the 794 samples were positive for *M. tuberculosis* complex and 481 grew a nontuberculous mycobacteria. The 315 *M. tuberculosis* complex-positive samples were identified from 165 patients; 163 had *M. tuberculosis* complex alone and 2 had *M. tuberculosis* complex and a nontuberculous mycobacteria. The average time from sample receipt to the identification of *M. tuberculosis* complex isolates was 15.4 days, with 79.4% identified within 21 days and a range of 3 to 41 days. Nontuberculous mycobacteria alone were identified from 290 patients. Nontuberculous mycobacteria identified were comprised primarily of *Mycobacterium avium-intracellulare* complex (MAC) (grown from 212 patient samples), *Mycobacterium gordonae* (56 patients) and lower numbers of *Mycobacterium abscessus* (5 patients), *Mycobacterium kansasii* (3 patients), and other species (1 or 2 patients each).

NAAT was completed on 864 smear-negative and 83 smear-positive samples. The sensitivity and specificity of the smear-positive samples was 100%. The sensitivity and specificity of the smear-negative samples was 71.0% and 98.8%, respectively. Accordingly, it is important to emphasize that NAAT cannot be used to rule-out *M. tuberculosis*, particularly in a smear-negative sample. The average time from specimen receipt to NAAT report was 3.4 days, with 40.5% completed within 2 days.

Of the 160 *M. tuberculosis* complex-positive index patients referred to the NRCM-NML for antimicrobial susceptibility testing and MIRU typing in 2022, 147 (91.9%) were susceptible to the

first-line agents, 8 (5.0%) demonstrated mono-resistance to isoniazid (1 low-level and 7 high-level resistance), 4 (2.5%) demonstrated mono-resistance to pyrazinamide and 1 (0.6%) was multidrug resistant (resistant to rifampin and isoniazid). The molecular prediction of resistance for isoniazid, rifampin and pyrazinamide demonstrated 100% correlation with the phenotypic resistance results. The correlation of susceptibility predictions by the absence of mutations correlated with phenotypic susceptibility results 98.7% of the time. Two isolates with no resistance mutations were phenotypically pyrazinamide resistant. The average turnaround time from the identification of *M. tuberculosis* complex to receipt of the molecular susceptibility results was 13.2 days. The average turnaround time from the identification of *M. tuberculosis* complex to receipt of the phenotypic susceptibility results was 19.5 days.

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