

Comparative Cost of Antimicrobial Susceptibility Testing using BIOMIC Disk Diffusion vs. the BD Phoenix™ AP Automated Microbiology Systems

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ABSTRACT

Background: NorthShore University HealthSystem is a four-hospital and associated outpatient network that serves the northern Chicago suburban area. All microbiology testing is done at a central laboratory located in Evanston Hospital. The Microbiology Laboratory processes approximately 29,200 unique specimens per year for antimicrobial susceptibility testing using disk diffusion. We compare the cost of semiautomated BIOMIC disk diffusion to an automated MIC test system.

Methods: Disk diffusion is performed using the BIOMIC semi-automated reader (Giles Scientific) with a two-way LIS interface. The automated MIC System with automated processing is the BD Phoenix™ AP Automated Microbiology System (BD Diagnostic Systems). The cost comparison includes materials (all consumables) and technician time. Timed measurements of technical procedures, published time measurements, manufacturers processing time data, and contracted prices for consumable materials were used to determine costs. Average technician cost (including benefits) for a midrange technologist in our setting is \$32/hr. Instrument purchase and preventive maintenance costs were not included in the calculations.

Results: Cost of materials for performing antimicrobial susceptibility testing using BIOMIC disk diffusion is \$1.49/test. In our hospital system, this equates to \$43,508 per year. Each specimen takes approximately 224 seconds to setup and interpret (1,817 technician hours or \$58,144/year for all tests). Cost of materials using the BD Phoenix™ AP system is \$5.68/test or \$165,856.00/year. Setup and interpretation time is 102 seconds/specimen (827 technician hours or \$26,464/year for all tests).

Conclusion: The BD Phoenix™ AP Automated Microbiology System costs \$6.59 and the BIOMIC Disk Diffusion \$3.48 per test. In our setting, the BD Phoenix System saves approximately 0.5 FTE but would cost \$90,668 more per year because of greater materials costs.

BACKGROUND

- According to the College of American Pathologists 2009 and 2010 Bacteriology Survey Participant Summaries, only 6-9% of laboratories perform Gram-negative or Gram-positive antimicrobial susceptibility testing using disk diffusion
- Disk diffusion is a standardized, accurate and inexpensive methodology for testing antimicrobial susceptibility.
- Although the BIOMIC Microbiology System provides semi-automated reading of disk plates, disk diffusion remains relatively labor intensive
- Multiple automated platforms for antimicrobial susceptibility testing are available. All have the advantage of requiring less technical time for set-up and interpretation, but have higher reagent costs
- We determined whether cost savings from decreased technical time would offset increased reagent costs by comparing disk diffusion performed using the BIOMIC Microbiology System to automated testing using the BD Phoenix™ AP Microbiology System

METHODS

- Total hands-on technical time for BIOMIC disk diffusion was determined by timing a series of specimens processed by multiple technologists on four different days. A BIOMIC – LIS interface uploaded demographics and downloaded results. Technologists were blinded to the purpose of the timed study
- For ease of analysis, BIOMIC disk diffusion antimicrobial susceptibility testing was broken down into four distinct tasks
 - Patient data selection and label printing
 - McFarland dilution preparation
 - Mueller-Hinton plate inoculation and antimicrobial disk placement
 - BIOMIC plate scanning and interpretation
- Average time per BIOMIC specimen was then calculated
- For the automated Phoenix™ AP system, hands-on technical time was obtained from BD Diagnostic Systems published data
- Cost per test for the BIOMIC disk diffusion system was determined based on current media and reagent prices
- Cost per test for the Phoenix™ AP system was obtained from BD Diagnostic Systems based on a quoted price for a volume of 28,000 tests per annum.

Results

COST OF REAGENTS – per specimen

Cost per test of reagents for automated testing using the Phoenix™ AP and Disk Diffusion using the BIOMIC

Automated (Phoenix)	Disk Diffusion (BIOMIC)		
AST Panel	4.23	150 mm Agar Plate	0.57
ID Broth	0.45	Antimicrobial Disks (12)	0.6
AST Broth	0.45	Sterile Swab	0.02
AP ID Solution	0.08	Snap-Cap Tube	0.16
AP Tip Waste Liner	0.02	Saline	0.01
AP Waste Bottle	0.03	Purity Plate	0.1
AP Pump Tubing	0.02	Labels	0.03
AP AST Indicator	0.07		
AP Pipette Tips	0.33		
Total	\$5.68	Total	\$1.49

COST OF REAGENTS – per year

- At a volume of 29,200 tests per year
 - \$165,856/year for automated Phoenix AP
 - \$43,508/year for disk diffusion using BIOMIC

COST OF TECHNICAL TIME (LABOR) – per specimen

Hands on time for Disk diffusion using:

BIOMIC

Data selection and label printing = 48.4 seconds
 McFarland dilution = 42.7 seconds
 Plate inoculation and disk placement = 69.9 seconds
 Scanning and interpretation = 62.6 seconds
 Total time = 223.6 seconds/specimen

Published total hands on time for setup and interpretation for automated testing using **Phoenix™ AP**:
 Total time = 102 seconds/specimen

Results – continued

COST OF TECHNICAL TIME (LABOR) – per year

- At a volume of 29,200 tests/year
 - Disk diffusion using BIOMIC
 - 1,817 technical hours/year
 - Automated testing using Phoenix AP
 - 827 technical hours/year
- For a mid-range technical salary of \$32/hour
 - Disk diffusion using BIOMIC total labor cost
 - \$58,144 per year
 - Automated testing using Phoenix AP
 - \$26,464 per year

CONCLUSIONS

- In our laboratory
 - The automated Phoenix AP System
 - Costs \$6.59 / test
 - Costs \$192,320 / year for our test volume
 - Disk diffusion using the BIOMIC System
 - Costs \$3.48 / test
 - Costs \$101,652 / year for our test volume
- In our laboratory
 - The BD Phoenix System saves approximately 0.5 FTE but would cost \$90,668 more per year because of greater materials costs

REFERENCES

- Analysis of the BD Phoenix™ AP Workflow; J. T. Page, A. L. Gibson, K. D. King, T. Daniel, P. Campognone; BD Diagnostics, Sparks, MD; *As presented at the 108th General Meeting of the American Society for Microbiology. June, 2008, Boston, MA*
- Cost of BD Phoenix™ AP reagents and disposables obtained from a price quote from BD Diagnostics, based on a volume of approximately 28,000 tests per year.

