

Direct Comparison of the BD Phoenix™ Automated Microbiology System with the Microscan Walkaway for Identification and Antimicrobial Susceptibility Testing of Staphylococci, Enterococci, and Antimicrobial Susceptibility of Streptococci.

J. W. Snyder^{1,2}, G. Munier² and C. Johnson²

University of Louisville School of Medicine¹ and University of Louisville Hospital² • Louisville, KY

REVISED ABSTRACT

BACKGROUND: The Phoenix™ Automated Microbiology System (BD Diagnostic Systems, Sparks, MD) is designed for the rapid identification (ID) and antimicrobial susceptibility testing (AST) of clinically significant human bacterial pathogens. In this study, we evaluated the performance and accuracy of the Phoenix™ against the Microscan Walkaway (Dade Behring, Sacramento, CA) for ID and AST of staphylococci and enterococci. Comparative AST was evaluated for pneumococci, beta-hemolytic streptococci, and viridans streptococci.

METHODS: Panels used: Phoenix gram-positive PMIC/ID-100, Streptococci (SMIC/ID), and Microscan (Pos BP Combo Panel Type 20, MicroStrep Plus Panel Type 1). ID results were compared for genus and species agreement, respectively. The bioMerieux API Staph Strip and API 20 Strep served as the reference methods for resolving discordant ID results. The Bauer Kirby Disc Diffusion served as the primary reference AST method in resolving discordant AST results.

RESULTS: The overall ID agreement for *S. aureus* to the genus and species level was 100% and 99.1%, respectively. For coagulase-negative staphylococci, the overall agreement to the genus and species level was 100% and 73.3%, respectively. There was 100% agreement at the genus and species level for the ID of enterococci. For AST, the Phoenix accurately detected 100% of the MRSA strains (N=50) and there were no very major discrepancies. No very major or major errors were encountered with viridans streptococci, beta-hemolytic streptococci (N=8 Group A, 1 Group B, and 1 Group C) or *S. pneumoniae*. The Phoenix accurately detected all VRE (N=10).

CONCLUSION: The Phoenix system compares favorably to the Microscan Walkaway for ID and AST of staphylococci and enterococci, for the detection of MRSA and VRE, and AST of *S. pneumoniae*, viridans streptococci, and beta-hemolytic streptococci.

ACKNOWLEDGMENTS

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INTRODUCTION

The Phoenix™ Automated Microbiology System (Phoenix System; BD Diagnostics, Sparks, MD) is designed for the rapid identification (ID) and antimicrobial susceptibility testing (AST) of clinically significant human bacterial pathogens. The system includes an instrument, software, disposable panels, broths for ID and AST, and an AST indicator. The ID method employs modified conventional, fluorogenic, and chromogenic substrates. The AST method is a broth based microdilution test that utilizes a redox indicator to enhance the detection of organism growth. The instrument has the capacity to hold 100 test panels. The disposable test panels contain 136 microdilution wells and are available in ID, ID/AST and AST only formats. The panels are read at 20-minute intervals by the instrument. IDs, minimal inhibitory concentrations (MICs), and category interpretations are generated. Final results are available in 2-12 hours for ID and 4-16 hours for AST.

In this head to head study, we compared the Phoenix System to our current system, the Microscan Walkaway (Dade Behring, Sacramento, CA) with respect to ID and/or AST of *Staphylococcus* spp., *Enterococcus* spp., *Streptococcus* spp., and *Listeria*.

OBJECTIVES

1. **Accuracy.** Performance characteristics of the system determined by a paired comparison of the Phoenix ID/AST system to the Microscan Walkaway results for ID and AST.
2. **Detection of Specific Resistance Phenotypes.** Compare the Phoenix ID/AST system to the Microscan Walkaway in the screening and detection of MRSA, VRE, and PRSP.

MATERIALS AND METHODS

Accuracy Testing (ID). Fresh clinical isolates were tested and reflected our laboratory's routine as to the species mix. The organism mix included: 200 *Staphylococcus* spp., (maximum of 50% to be *S. aureus*: 25 MRSA, 25 MSSA), 50 *Enterococcus* spp., including a minimum of 10 VRE and a maximum of 25 of any one species; 20 *Streptococcus* spp. (other than *S. pneumoniae*) comprised of 50% beta hemolytic and 50% non-beta hemolytic strains; 30 *S. pneumoniae* (minimum of 5 Penicillin resistant strains), and 5 *Listeria* spp.

Each isolate for ID/AST was setup concurrently in the Phoenix system and the Microscan Walkaway for genus and species identification, and category susceptibility determinations, respectively. The identification results from the two systems were compared for genus agreement and species agreement. The identification was considered to be correct when the two systems agreed to the genus and species level. When the species were not in agreement for the two systems, the isolate was retested (in duplicate) in parallel in both systems.

MATERIALS AND METHODS continued

AST. All panels, Phoenix PMIC/ID-100, SMIC/ID-100 (*S. pneumoniae*), and Microscan Pos BP Combo Panel Type 20, MicroSTREP Panel Type I (*S. pneumoniae*), were inoculated according the respective manufacturer’s directions. Category concordance was evaluated after application of the Phoenix BDXpert system and the Microscan LabPRO system, respectively. Only those antibiotics that are tested in both systems were evaluated. Equivalent results were considered correct. If the

AST were discrepant, isolates were re-tested in duplicate and in parallel in both systems. If the results remained discrepant, the isolate was tested using the Bauer Kirby Disk Diffusion method. Error rates (Very Major, Major) were calculated for each system compared to disk diffusion.

Quality Control. Quality control strains were tested in each system according to the respective manufacturer’s recommendations.

RESULTS

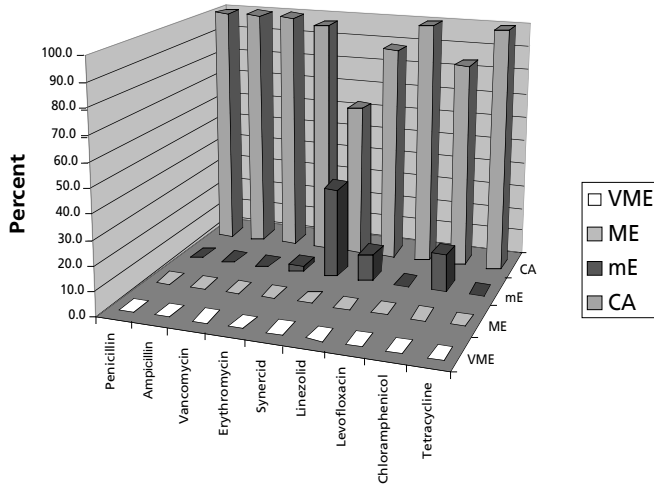
Table 1. Identification Results for Gram Positive Organisms

organism	n	% of Phoenix ID		Manual ID
		concordant	discordant	
Staphylococcus:				
<i>Staphylococcus aureus</i>	110	100	0	see Table 2
Coagulase negative Staphylococci	101	73.3	26.7	
TOTAL:	211			
Enterococci:				
<i>Enterococcus faecalis</i>	23	100	0	
<i>Enterococcus faecium</i>	19	100	0	
<i>Enterococcus gallinarum</i>	3	100	0	
<i>Enterococcus casseliflavus</i>	1	100	0	
TOTAL:	46			

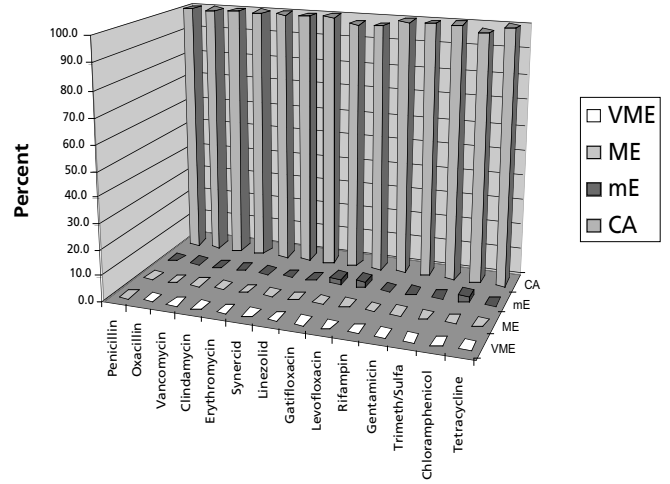
Table 2. Species Level Identification for Coagulase Negative Staphylococci

n	MicroSCAN ID	Phoenix ID
54	<i>Staphylococcus epidermidis</i>	<i>Staphylococcus epidermidis</i>
2	<i>Staphylococcus saprophyticus</i>	<i>Staphylococcus saprophyticus</i>
6	<i>Staphylococcus hominis</i>	<i>Staphylococcus hominis</i>
6	<i>Staphylococcus haemolyticus</i>	<i>Staphylococcus haemolyticus</i>
4	<i>Staphylococcus capitis</i>	<i>Staphylococcus capitis</i>
2	<i>Staphylococcus lugdenensis</i>	<i>Staphylococcus lugdenensis</i>
6	Coagulase negative Staphylococci	<i>Staphylococcus epidermidis</i>
3	<i>Staphylococcus epidermidis</i>	<i>Staphylococcus warneri</i>
2	<i>Staphylococcus auricularis</i>	<i>Staphylococcus cohnii</i>
3	<i>Staphylococcus epidermidis</i>	<i>Staphylococcus hominis</i>
1	Coagulase negative Staphylococci	<i>Staphylococcus capitis</i>
1	Coagulase negative Staphylococci	<i>Staphylococcus hominis</i>
1	Coagulase negative Staphylococci	<i>Staphylococcus haemolyticus</i>
1	<i>Staphylococcus auricularis</i>	<i>Staphylococcus capitis</i>
1	<i>Staphylococcus capitis</i>	<i>Staphylococcus caprae</i>
1	<i>Staphylococcus epidermidis</i>	<i>Staphylococcus aureus</i> ¹
1	<i>Staphylococcus haemolyticus</i>	<i>Staphylococcus warneri</i>
1	<i>Staphylococcus haemolyticus</i>	<i>Staphylococcus lugdenensis</i>
2	<i>Staphylococcus hominis</i>	<i>Staphylococcus epidermidis</i>
1	<i>Staphylococcus hominis</i>	<i>Staphylococcus capitis</i>
1	<i>Staphylococcus simulans</i>	<i>Staphylococcus epidermidis</i>
1	<i>Staphylococcus warneri</i>	<i>Staphylococcus aureus</i> ²

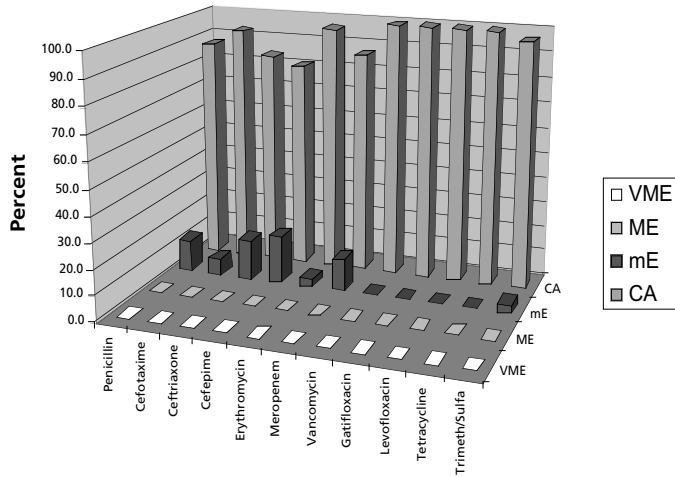
Enterococcus Susceptibilities



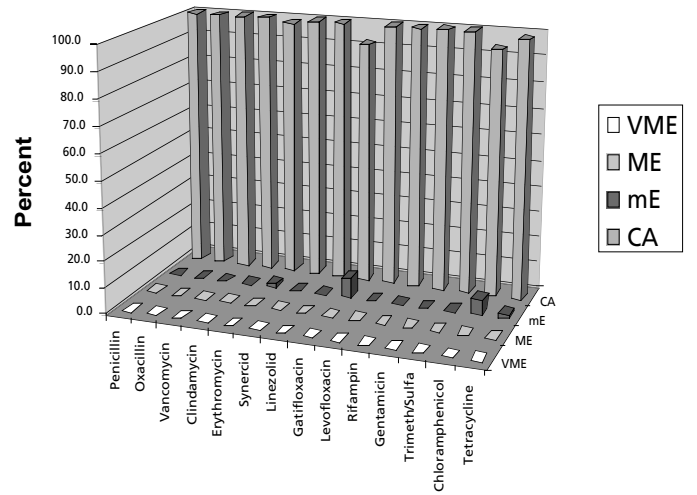
Methicillin Sensitive Staphylococcus aureus Susceptibilities



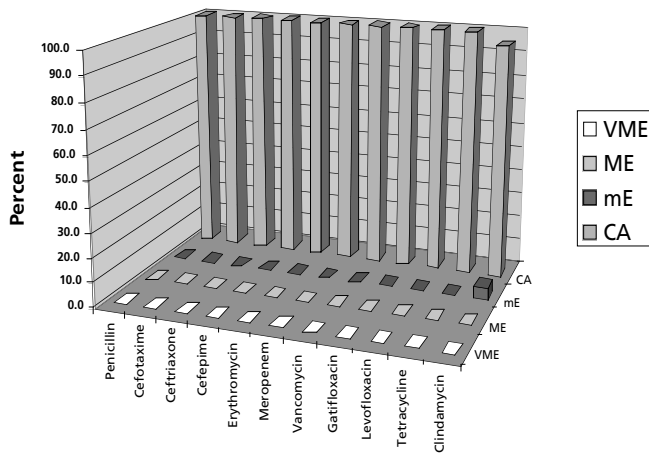
Streptococcus pneumoniae Susceptibilities



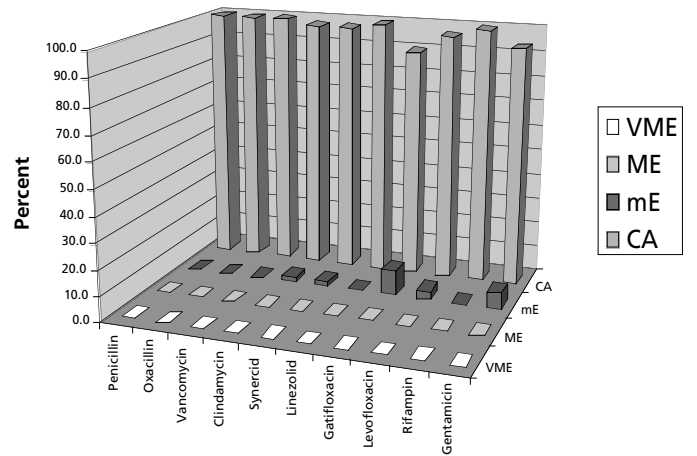
Methicillin Resistant Staphylococcus aureus Susceptibilities



Streptococcus (other than pneumoniae) Susceptibilities



Coagulase Negative Staphylococci Susceptibilities



SUMMARY OF RESULTS

1. There was 100% agreement (110/110) between both systems for the ID of *S. aureus* at the genus and species level (Table 1).
2. For non-SA staphylococci, there was 73.3% (74/101) for ID of 9 species. One *S. epidermidis* was identified as *S. aureus* by the Phoenix and one *S. warneri* was misidentified as *S. aureus* by the Microscan (Table 2). The remaining species discrepancies between the two systems were not independently resolved.
3. The overall rate of agreement between the two systems for genus and species level ID for *Enterococcus* was 100% (Table 1); N=23 *E. faecalis*, N=19 *E. faecium*, N=3 *E. gallinarum*, N=1 *E. casseliflavus*.
4. For AST results, the rate of categorical agreement between both systems exceeded 98% for all antibiotics tested (Figures 1 thru 6).
5. There were no Very Major or Major errors for any of the drug-bug combinations. Minor errors accounted for all of the AST discrepancies: Methicillin Susceptible *S. aureus* (gatifloxacin, levofloxacin, and chloramphenicol, Fig 1); MRSA (gatifloxacin, chloramphenicol and erythromycin, Fig 2); CNS (clindamycin, synercid, gatifloxacin, levofloxacin, and gentamicin, Fig. 3); Enterococci (erythromycin, synercid, linezolid, Fig 4); *S. pneumoniae* (penicillin, cefotaxime, ceftriaxone, cefepime, erythromycin, meropenem, and trimethoprim/sulfamethoxazole, Fig. 5); other Streptococci (clindamycin; Fig. 6).

CONCLUSION

- The Phoenix system compares favorably to the Microscan Walkaway for ID and AST of staphylococci and enterococci, for the detection of MRSA and VRE, and AST of *S. pneumoniae*, viridans streptococci, and beta-hemolytic streptococci.