

Comparison of MicroScan Walk-Away[®], Phoenix[™] and VITEK-TWO[®] Microbiology Systems Used in the Identification and Susceptibility Testing of Bacteria

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REVISED ABSTRACT

We compared three automated microbiology systems: MicroScan Walk-Away[®] (DADE BEHRING INC., West Sacramento, CA), Phoenix[™] [P] (Becton Dickinson Diagnostic Systems, Sparks, MD) and VITEK-TWO[®] [V] (bioMérieux, Durham, NC). Two different panels were used with the MicroScan system: Rapid [MR] and conventional [MC]. Organisms tested included clinical isolates from cultures obtained from a variety of body sites from patients at SLCH and a subset of challenge organisms. The comparison standard was identification by a reference lab (Missouri Department of Health or CFF B. cepacia Research Laboratory, Ann Arbor, MI) or, when not available, consensus defined as two or more systems with matched results. To date, 363 isolates have been tested of which 347 have reference lab or consensus identification to species level.

IDENTIFICATION SUMMARY

	No. tested	No. (%) correctly identified			
		MR	MC	P	V
Gram-negative	224	184 (82%)	176 (79%)	208 (93%)	172 (77%)
Gram-positive	123	102 (83%)	94 (76%)	110 (89%)	99 (80%)

NOTE: Gram-negative isolates were analyzed and compared at the species level when possible. When species level identification was not possible comparison was at the genus level. Gram-positive isolates were always analyzed and compared at the species level.

ANTIMICROBIAL SUSCEPTIBILITY TEST (AST)

SUMMARY. For susceptibility testing, 296 isolates were tested with a total of 2723 antimicrobials. The number of major errors and very major errors per system: MC 4/2, P 3/0 and V 1/3. Each system was unable to perform susceptibility for such reasons as no organism identification provided by the system or the identified organism not in system's AST database. The number of susceptibility results that were not available per system: M 469/2723 (17%), P 342/2723 (13%) and V 667/2723 (24%).

TIME STUDY. Time to perform daily maintenance and panel set up times were analyzed for each system. The time to perform daily maintenance of each system (minutes): M 3.4, P 1.25 and V 0.9. The time to set up one panel per system (minutes): M 3.53, P 3.4 and V 3.19.

INTRODUCTION

In most clinical laboratories a quick and accurate identification of organisms is important for successful treatment of patients with bacterial infections. Restraints placed on busy clinical laboratories in today's healthcare setting mandate efficient work effort. Repeat testing or additional off-line testing delay results. In addition, susceptibility rules require accurate organism identification in order to apply identification-based algorithms.

In this study we compared automated systems from 3 different manufacturers, Becton Dickinson (Phoenix), BioMérieux (VITEK 2) and DADE BEHRING (MicroScan). DADE BEHRING provided two different systems for our study (Rapid Identification and Conventional ID/AST combination).

Acknowledgement

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METHODOLOGY

Three automated identification and AST systems were compared using organisms from clinical patient samples along with a subset of challenge organisms. All inocula for testing were prepared from the same 18-24 h subculture from a tryptic soy agar with sheep blood that was incubated in O₂ for gram-negative and CO₂ for gram-positive organisms (except MicroScan Rapid Negative). For the MicroScan Rapid Negative panel, we used an 18-24 h subculture from a MacConkey agar incubated in O₂.

Comparison Standard for Identification

The identification results from all systems were compared for species agreement. Off-line testing to speciate or discriminate was not used.

- If two or three manufacturers' systems obtained the same result, that result would be the comparison standard.
- If all systems disagreed, the organism was sent to the Missouri State Public Health Laboratory for identification or the CFF B. cepacia Research Laboratory. The State or CFF B. cepacia Research Lab identification was used as the comparison standard. If neither identify the organism, the isolate was removed from the study. 16 isolates were excluded for this reason.

Comparison Standard for Antimicrobial Susceptibility Testing (AST)

AST results were compared using isolates that had a consensus identification. Comparison was limited to antibiotics that were tested by all three systems. Any disagreements between the systems that involved S to R or R to S were further analyzed using a MIC broth microdilution reference method as described in the National Committee for Clinical Laboratory Standards (NCCLS) 2003. "Methods for Dilution Antimicrobial Susceptibility Test for Bacteria that Grow Aerobically; Approved standard M2-A6. Major error or very major error definitions were those of the U.S. Department of Health and Human Services, Food and Drug Administration, 2003. Class II Special Control guidance Document: Antimicrobial Susceptibility Test (AST) Systems; Guidance for Industry and FDA. A major error was defined as Reference susceptible, test resistant. A very major error was defined as Reference resistant, test susceptible. Any isolate that fell into the major error or very major error category was repeated by the instrument yielding the discrepant result. Minor errors were not analyzed in this study. Only reproducible discrepancies were counted for analysis.



	MicroScan	Phoenix	VITEK 2
Time to perform daily maintenance	3.40 min	1.25 min	0.9 min
Time to set up one panel	3.53 min (with prompt [^])	3.40 min	3.19 min
Size: Height/Width/Depth (inches)	34/39/28.5	41.7/44.3/29.5	26.3/39.4/27.7
Weight (lbs)	400	333	240
Average time to identification	2.5 h (Rapid)* 6 – 18 h (Conventional)*	4.3 h*	3 h 5.7 h (Colorimetric)
Average time to AST	20 h	12 h	9 h

*provided by company

[^]Prompt Inoculation System-D provides the microbiologist with a method for obtaining standardized inocula while eliminating the need for turbidity adjustment.

Identification Summary

Organism	# Orgs Tested	MicroScan Rapid					MicroScan Conventional					Phoenix					VITEK 2				
		Match to Species Level	Match to Genus Level	Wrong ID	No ID	Failure to fully ID	Match to Species Level	Match to Genus Level	Wrong ID	No ID	Failure to fully ID	Match to Species Level	Match to Genus Level	Wrong ID	No ID	Failure to fully ID	Match to Species Level	Match to Genus Level	Wrong ID	No ID	Failure to fully ID
Enteric GNB	133	108	15	1	2	7	120	5	1	1	6	127	3	3	0		111	9	1	3	9
Non-Enteric GNB	91	41	20	2	12	16	39	12	7	12	21	54	24	6	7		41	11	3	33	3
<i>Staphylococcus</i>	61	50	*	9		2	52	*	4		5	57	*	3	1		53	*	2	2	4
<i>Streptococcus</i>	49	44	*		2	3	32	*	3	5	9	40	*	6	1	2	33	*		5	11
<i>Enterococcus</i>	11	8	*	1		2	9	*	1		1	11	*				11	*			
Other GPC	2		1		1		1	1				2					2				
Total	347	251	36	13	17	30	253	18	16	18	42	291	27	18	9	2	251	20	6	43	27
%		72	10	4	5	9	73	5	5	5	12	84	8	5	3	0.5	72	6	2	12	8

**Staphylococcus*, *Streptococcus* and *Enterococcus* were not evaluated for genus level only identification

Failure to fully ID: Isolates that were included as a possible identification with a low probability. Further testing needed to differentiate.

Identification Summary (Continued): Including Testing with VITEK 2 Colorimetric Card

Organism	# Tested	MicroScan Rapid					MicroScan Conventional					Phoenix				
		Match to Species	Match to Genus	Wrong ID	NO ID	Failure to fully ID	Match to Species	Match to Genus	Wrong ID	NO ID	Failure to fully ID	Match to Species	Match to Genus	Wrong ID	NO ID	Failure to fully ID
Enteric GNB	17	11	5			1	14	1			2	16	1			
Non-enteric	39	10	7		4	18	10	9	1	5	14	13	17	4	5	
<i>Staphylococcus</i>	7	4				3	5		2			4		2	1	
<i>Streptococcus</i>	11	10				1	7			1	3	8		2		1
Total	74	35	12		4	23	36	10	3	6	19	41	18	8	6	1
		47 (62%)					46 (62%)					59 (80%)				

Organism	# Tested	VITEK 2					VITEK 2 Colorimetric				
		Match to Species	Match to Genus	Wrong ID	NO ID	Failure to fully ID	Match to Species	Match to Genus	Wrong ID	NO ID	Failure to fully ID
Enteric GNB	17	1	6	1	1	8	7	9			1
Non-enteric	39	1	2	4	29	3	28	6	3		2
<i>Staphylococcus</i>	7	1		2	1	3	6		1		
<i>Streptococcus</i>	11				1	10	10			1	
Total	74	3	8	7	32	24	51	15	4	1	3
		11 (15%)					66 (89%)				

Antimicrobial Susceptibility Testing Summary

Organism	# Orgs Tested	Total # abx Tested	MicroScan			Phoenix			Vitek2		
			Very Major Error	Major Error	Not Available	Very Major Error	Major Error	Not Available	Very Major Error	Major Error	Not Available
Enteric GNB	133	1580	1		107		1	61	1		229
Non-enteric GNB	91	611	1		282			249	1		374
<i>Staphylococcus</i>	61	488		4	72		2	32	1	1	64
<i>Enterococcus</i>	11	44			8						
Total	296	2723	2	4	469	0	3	342	3	1	667

Not Avail: No susceptibility results available due to either no organism identification from a system or organism identification not in system's database

MicroScan, Phoenix and VITEK 2 had 107, 133 and 25 susceptibility results respectively available but with no other system to compare

Summary of Major and Very Major Errors

Study #	Antibiotic	Organism	Reference MIC [*]	MicroScan	Phoenix	VITEK 2	
135	Cephalothin	<i>K. oxytoca</i>	R	R	I	S	
196	Clindamycin	<i>S. epidermidis</i>	S	R	R	S	
63	Gentamicin	<i>S. aureus</i>	R	I	R	S	
196	Levofloxacin	<i>S. epidermidis</i>	S	R	R	S	
195	Levofloxacin	<i>S. haemolyticus</i>	S	R	S	S	
102	Oxacillin	<i>S. lugdenensis</i>	S	R [^]	S		
289	Penicillin	<i>S. saprophyticus</i>	S	S		R	
294	Timentin	<i>C. koseri</i>	S	S	R	S	
28	Timentin	<i>E. coli</i>	R	S	R	I	
66	Trimethoprim Sulfamethoxazole	<i>S. maltophilia</i>	R	S	R		
150	Trimethoprim Sulfamethoxazole	<i>S. maltophilia</i>	R	R	R	S	
				Major errors	4	3	1
				Very Major errors	2	0	3

* MicroScan actual Mic value same as reference value; interpretation different

[^] Reference broth microdilutions performed at Clinical Microbiology Institute, Wilsonville, OR 97070

CONCLUSIONS

- Identification:
 - All 4 systems provided a high level of accurate identification.
 - Phoenix had the highest number of correct identifications.
 - VITEK 2 Fluorimetric method had the fewest number of wrong identifications.
 - VITEK 2 Fluorimetric method had the largest combined number of no identifications and organisms that failed to fully identify, whereas Phoenix had the fewest number.
 - Phoenix performed better for non-enteric GNB than the other systems.
 - MicroScan Conventional Panel had the most organisms that failed to fully identify.
 - In a limited evaluation, VITEK 2 Colorimetric card provided improved identifications compared to VITEK 2 Fluorimetric card.
- Susceptibility:
 - Major and Very Major Errors were infrequent in all systems.
 - Each system has limitations of testing drug/bug combinations that could pose problems for clinical laboratories. Phoenix has the greatest number of limitations.
- Time Study:
 - Time to identification was longest for MicroScan Conventional Panel.
 - Time to AST was longest for MicroScan Conventional Panel.
 - Time to set up per test was similar for all systems.