

Comparison of StarSwab II with BD CultureSwab Max V(+) Transport Systems for Preservation of Bacterial Pathogens Important in Pediatric Medicine; *Hemophilus influenzae*, *Streptococcus pneumoniae*, and *Neisseria meningitidis*

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ABSTRACT: #C-300

Comparison of StarSwab II with BD CultureSwab MaxV(+) Transport Systems for Preservation of Bacterial Pathogens Important in Pediatric Medicine; *Hemophilus influenzae*, *Streptococcus pneumoniae*, and *Neisseria meningitidis*. RC Jerris, DK Jarrett, W Cherney, Children's Healthcare of Atlanta. Atlanta, GA

A critical aspect of a transport system is the ability to preserve fastidious pathogens. We conducted a comparative evaluation to determine what might be the optimum swab transport for use in our pediatric facility. Using the NCCLS (M40-A) quantitative Swab Elution Method for evaluation of transport systems, we compared the room temperature performance characteristics of the StarSwab II (Starplex) (SS) with a new BD CultureSwab MaxV (+) (MAX). The MAX swab contains a blend of vegetable proteins added to the rayon fibers during the manufacturing process which is believed to improve organism viability. For each holding time point (0h, 24h and 48h) swabs were inoculated in triplicate with 100µl of 1/10 dilution of a 0.5 McFarland suspension of each test organism. At 0, 24 and 48h viability was determined by making vortex suspensions from the swabs then ten fold serial dilutions. Duplicate plate counts were performed from the vortex suspensions and serial dilutions. Plate counts were average from all dilutions and time points to compare organism viability. Test organisms included significant pediatric pathogens: *H.influenzae* ATCC 35540 (HI); *S.pneumoniae* ATCC 49619 (PN), and; *N.meningitidis* ATCC 13102 (NM). With HI, the % recovery at 24h and 48h with SS and MAX respectively, was 7.95 and 0.05 vs. 100 and 80. With PN, the % recovery at 24h and 48h with SS and MAX respectively was, 17.8 and 2 vs. 11.4 and 79.5. With NM, the % recovery at 24h and 48h with SS and MAX respectively was 1.89 and 0 vs. 100 and 33.7. In these studies the MAX outperformed the SS. These results have significant implications for recovery of these pediatric pathogens, especially when screening for carriage or when post exposure contact is required.

INTRODUCTION

The transport of clinical specimens is essential for accurate diagnosis. When swabs must be used for transport, it is critical that specimens be maintained in an environment that:

- 1.) Preserves viability to include fastidious organisms;
- 2.) Allows recovery of organisms in proportion to their original concentration;
- 3.) Prevents overgrowth of any particular species, and;
- 4.) Allows routine laboratory processing to detect and grow microorganisms.

Transport devices differ dramatically and have continued to evolve over time to recover a wide variety of microorganisms from bacteria to viruses. These systems differ in their components including: the tips (sponges or swabs of natural cotton or synthetic substances); the shafts (wooden, metal, or synthetic), and; other influencing substances (eg. glue for adhering the swab to the shaft and residual chemicals that may be present either in the swab or the shaft). In addition, transport media differ in their components (gel, liquid, media adherent to swab fibers or sponges and additives to eliminate toxic substances in clinical specimens-charcoal, etc.). In order to provide standard criteria to evaluate these systems, in 2003, the NCCLS published guideline M40-A "Quality Control of Microbiological Transport Systems".

As part of a performance improvement project stemming from samples being submitted to us from multiple off-campus sites and because of delays in transport, we sought a transport system that would maintain organism viability for up to 48h.

We used the SWAB ELUTION (SE) method as outlined in the above document to evaluate the StarSwab II (Starplex) (SS) [Starplex Scientific, Ontario, Canada] and the new BD CultureSwab MaxV (+) (MAX)[Becton Dickinson, Sparks,MD] with the significant pediatric pathogens: *H.influenzae* ATCC 35540 (HI); *S.pneumoniae* ATCC 49619 (PN), and; *N.meningitidis* ATCC 13102 (NM). Both systems employ Amies Agar Gel as transport media, however, the MAX rayon swab is impregnated with vegetable protein during the manufacturing process. We evaluated the quantitative room temperature performance of these swabs at time 0, 24h and 48h.

MATERIALS AND METHODS

1. Two types of commercially available Amies without charcoal swab transport systems were evaluated:
 - BD CultureSwab MaxV(+) (MAX)**
 - Starplex Starswab II (SS)**
2. The Swab Elution method outlined in the NCCLS M-40 standard criteria was used to determine colony counts. In brief:
 - a. Lyophilized cultures of *Haemophilus influenzae* ATCC 35540, *Neisseria meningitidis* ATCC 13102 and *Streptococcus pneumoniae* ATCC 49619 were plated to non-selective media and subcultured twice prior to use. Direct colony suspensions were prepared using isolated colonies of 18-24 hour growth and were adjusted to a 0.5 McFarland density (1.5×10^8) with the use of a spectrophotometer.
 - b. The 0.5 McFarland density suspension was diluted 1:10 in 0.85% sterile saline.
 - c. One hundred µl of this suspension was pipetted into the well of a microtitre plate.
 - d. The swab was placed in the well of the microtitre plate and allowed to absorb the suspension for 10 seconds.
 - e. Swabs were returned to their transport devices and held for 0, 24 and 48 hours at room temperature (RT). Each swab type was tested in triplicate.
 - f. At the appropriate time points, swabs were eluted in 1ml of 0.85% sterile saline by 15 seconds of vortex mixing.
 - g. Three 10-fold serial dilutions of the swab elution suspension were made.
 - h. One hundred µl from the primary swab elution suspension and from each serial dilution were plated, in duplicate, to non-selective media and incubated at 35°C for 24 hours.
 - i. Colony counts were made on plates containing between 30 and 300 colonies and were used to determine the recovery of viable organisms.



BD CultureSwab MaxV(+)



Starplex Starswab II

RESULTS

RESULTS

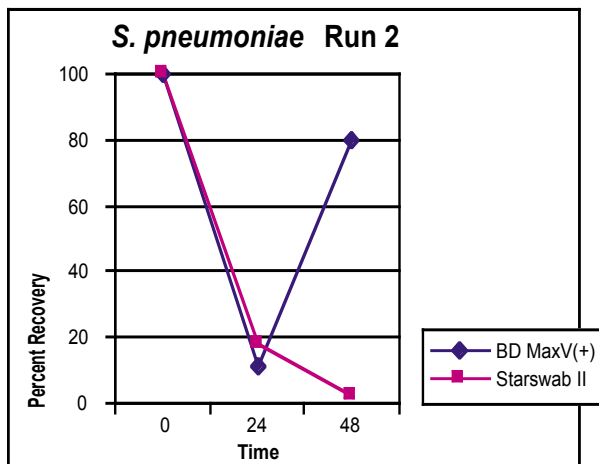
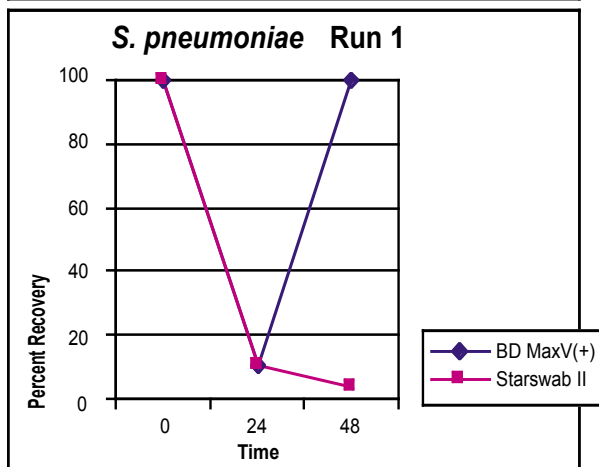
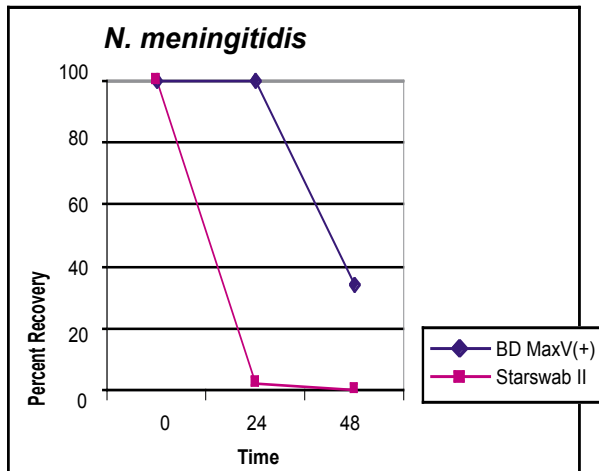
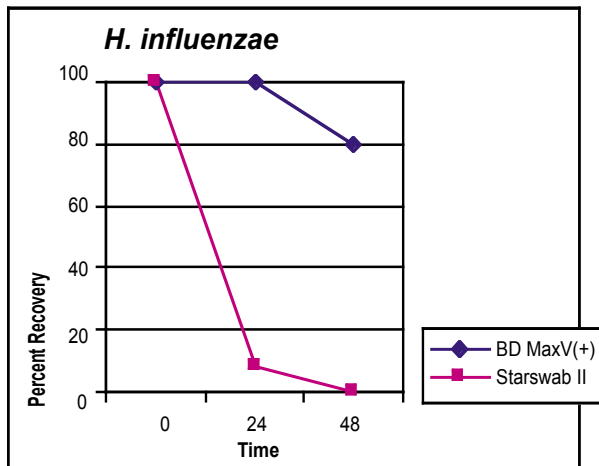
<i>N.meningitidis</i>	BD CultureSwab MaxV(+)				Starplex StarSwab II			
	T0				T0			
	1 ^o Vortex	Dilution 10 ⁻¹	Dilution 10 ⁻²	Dilution 10 ⁻³	1 ^o Vortex	Dilution 10 ⁻¹	Dilution 10 ⁻²	Dilution 10 ⁻³
Average Colony Count (Swabs 1-3)	>300	>300	261.2	33.8	>300	>300	>300	64.3
Average Countable Dilution	3.00 x 10 ⁴				6.43 x 10 ⁴			
% Recovery	100				100			
	T24				T24			
Average Colony Count (Swabs 1-3)	>300	>300	>300	55.6	122.2	<30	<30	<30
Average Countable Dilution	5.56 x 10 ⁴				1.22 x 10 ²			
% Recovery	>100				1.89			
	T48				T48			
Average Colony Count (Swabs 1-3)	>300	>300	101.6	<30	NG	NG	NG	NG
Average Countable Dilution	1.01 x 10 ⁴				0			
% Recovery	33.7				0			

<i>H.influenzae</i>	BD CultureSwab MaxV(+)				Starplex StarSwab II			
	T0				T0			
	1 ^o Vortex	Dilution 10 ⁻¹	Dilution 10 ⁻²	Dilution 10 ⁻³	1 ^o Vortex	Dilution 10 ⁻¹	Dilution 10 ⁻²	Dilution 10 ⁻³
Average Colony Count (Swabs 1-3)	>300	>300	>300	94.1	>300	>300	>300	59.8
Average Countable Dilution	9.41 x 10 ⁴				5.98 x 10 ⁴			
% Recovery	100				100			
	T24				T24			
Average Colony Count (Swabs 1-3)	>300	>300	>300	97.6	>300	>300	47.6	<30
Average Countable Dilution	9.76 x 10 ⁴				4.76 x 10 ³			
% Recovery	>100				7.95			
	T48				T48			
Average Colony Count (Swabs 1-3)	>300	>300	>300	75.5	32	<30	<30	<30
Average Countable Dilution	7.55 x 10 ⁴				32			
% Recovery	80				0.05			

<i>S.pneumoniae</i> Run 1	BD CultureSwab MaxV(+)				Starplex StarSwab II			
	T0				T0			
	1 ^o Vortex	Dilution 10 ⁻¹	Dilution 10 ⁻²	Dilution 10 ⁻³	1 ^o Vortex	Dilution 10 ⁻¹	Dilution 10 ⁻²	Dilution 10 ⁻³
Average Colony Count (Swabs 1-3)	>300	103	31.5	<30	>300	280.5	37	<30
Average Countable Dilution	2.1 x 10 ³				3.25 x 10 ³			
% Recovery	100				100			
	T24				T24			
Average Colony Count (Swabs 1-3)	130.7	32	<30	<30	205.5	48.8	<30	<30
Average Countable Dilution	2.25 x 10 ²				3.42 x 10 ²			
% Recovery	10.7				10.5			
	T48				T48			
Average Colony Count (Swabs 1-3)	>300	135.5	164.5	49.5	118.5	<30	<30	<30
Average Countable Dilution	2.24 x 10 ⁴				1.19 x 10 ²			
% Recovery	>100				3.7			

<i>S.pneumoniae</i> Run 2	BD CultureSwab MaxV(+)				Starplex StarSwab II			
	T0				T0			
	1 ^o Vortex	Dilution 10 ⁻¹	Dilution 10 ⁻²	Dilution 10 ⁻³	1 ^o Vortex	Dilution 10 ⁻¹	Dilution 10 ⁻²	Dilution 10 ⁻³
Average Colony Count (Swabs 1-3)	>300	275	40	<30	>300	>300	58.5	<30
Average Countable Dilution	3.38 x 10 ³				5.85 x 10 ³			
% Recovery	100				100			
	T24				T24			
Average Colony Count (Swabs 1-3)	>300	53.5	<30	<30	>300	104.1	<30	<30
Average Countable Dilution	3.78 x 10 ²				1.04 x 10 ³			
% Recovery	11.4				17.8			
	T48				T48			
Average Colony Count (Swabs 1-3)	>300	133.5	40.5	<30	118	<30	<30	<30
Average Countable Dilution	2.69 x 10 ³				1.18 x 10 ²			
% Recovery	79.5				2			

RESULTS (continued)



DISCUSSION / CONCLUSIONS:

- As part of a performance improvement project in our Children's Hospitals, we evaluated 2 swab systems, the StarSwab II (Starplex) (SS) [Starplex Scientific, Ontario, Canada] and the new BD CultureSwab MaxV (+) (MAX) [Becton Dickinson, Sparks, MD] for their ability to recover of the pediatric pathogens, *Hemophilus influenzae*, *Neisseria meningitidis* and *Streptococcus pneumoniae*. Acceptable performance of transport systems for bacterial culture is critical to our laboratory outreach program, screening for carrier states, and outbreak investigations.
- We used procedures outlined for swab elution (SE) in the NCCLS M40-A document to evaluate performance of the 2 systems. To be acceptable, there should be no more than a 3 log₁₀ decline in CFU between the zero-time CFU count and the CFU after the specified holding period.
- With NM and SS, the count dropped over 2 log₁₀ (98% reduction) at 24h and to undetectable levels at 48 h.
- With NM and MAX, the count was maintained over the first 24h (100%) and fell less than 1 log₁₀ at 48h.
- With HI and SS, the count dropped 1 log₁₀ and 24h (92% reduction) and greater than 3 log₁₀ at 48h (99.95% reduction).
- With HI and MAX, the count was maintained at 100% for the first 24h and fell less than 1 log₁₀ (only a 20% reduction) at 48h.
- For 2 runs with PN and SS, the count fell approximately 1 log₁₀ at 24h with a further loss of less than 1 log₁₀ at 48h.
- For 2 runs with PN and MAX, counts fell approximately 1 log₁₀ at 24h, then increased to the original time-zero counts at 48h. This finding has also been noted by others when testing PN with the BBL Port-A-Cul system (4).
- Both systems met acceptable performance standards at 24h for all organisms.
- Both systems met acceptable performance standards at 48 h for PN.
- Only the MAX met acceptable performance for all organisms at 48h.

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