



# Comparison of an Automated Plate Assessment System (APAS Independence) and Artificial Intelligence (AI) to Manual Plate Reading of Methicillin-resistant *Staphylococcus aureus* Chromagar Surveillance Cultures

N. Gammel<sup>a\*</sup>, T. Ross<sup>a</sup>, S. Lewis<sup>b</sup>, M. Olson<sup>a</sup>, S. Henciak<sup>a</sup>, R. Harris<sup>a</sup>, K.C. Carroll<sup>b</sup>

Division of Medical Microbiology, Department of Pathology, The Johns Hopkins Hospital<sup>a</sup>, and the Johns Hopkins University School of Medicine<sup>b</sup>, Baltimore Maryland

## Introduction

Microbiology is a discipline that is heavily predicated upon image interpretation, whether it by microscopy of stained smears or manual interpretation of colony morphology of organisms growing on a broad range of media. Therefore, platforms that use artificial intelligence (AI) in algorithms that can automate interpretation and triage negative cultures from those requiring technologist intervention could increase both laboratory efficiency and test accuracy.

The Automated Plate Assessment System (APAS Independence) [Clever Culture Systems Baech, Switzerland] is an automated imaging station linked with interpretive software that detects colonies on chromogenic media and triages samples into categories of negative or presumptive positive. The APAS Independence software utilizes AI to interrogate colonies for size, pigment, and granularity. It can analyze up to 200 plates per hour. Figure 1 depicts the APAS instrument.



Figure 1: Automated Plate Assessment System Compliments of Peter Bradley LBT Innovations. <https://lbtinnovations.com/products/apas-independence/>

## Goals of the Study

We evaluated the APAS Independence's ability to accurately triage MRSA cultures compared to human interpretation.

## Materials and Methods

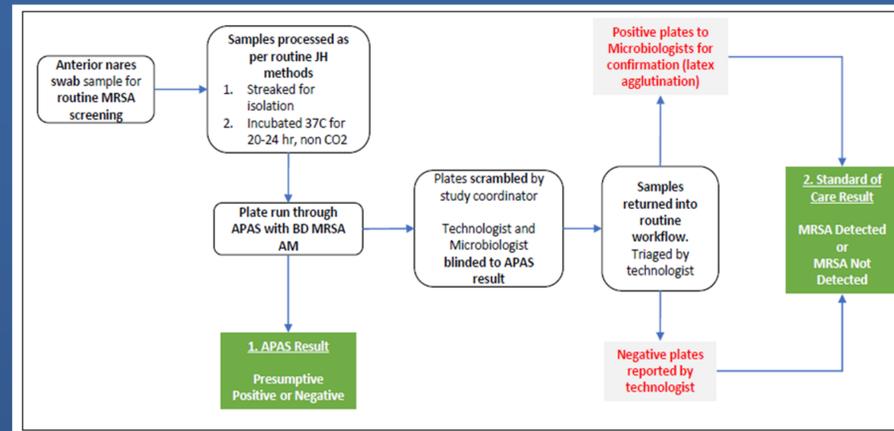


Figure 2: Study Workflow

At the Johns Hopkins Hospital (JHH) and two of its affiliate institutions (Bayview Medical Center and Howard County General Hospital), all patients admitted to intensive care units (ICU) and oncology units are screened weekly and on admission for MRSA colonization. Anterior nares samples are collected using eSwabs (Copan). In the laboratory these swabs are inoculated to BD BBL CHROMagar MRSA II using the walk away specimen processor (WASP). Following the manufacturer's guidelines, plates are incubated for 20-24 h at 37 C° in a non-CO2 incubator. On this chromogenic agar, a mauve colony is suggestive of MRSA. Mauve colonies are confirmed as *S. aureus* by latex agglutination.

Figure 2 describes the workflow for the study. Following incubation of the chromogenic agar, plates were loaded onto the APAS instrument by technologists who were not involved in clinically resulting MRSA cultures. After assessment by APAS, plates were unloaded from the instrument and scrambled by the operator before being handed off to a technologist or microbiologist for manual reading.

The APAS instrument software utilizes AI to interrogate colonies for size, pigment and granularity and analyzes 200 plates/h. Plates are triaged as negative or presumptive positive. Operators recorded the time plates were loaded onto the instrument and when all plates had been sorted.

Technologists recorded the time to manually sort plates as presumptive positive or negative and recorded the time to workup presumptive positives.

The number of presumptive positive and negative plates were noted by both APAS and manual reading. Discrepant analysis (disagreement between instrument vs manual reading) was performed by a third reader not involved in either assessment for a particular day.

## Results

### MANUAL

|      |            |             |
|------|------------|-------------|
| APAS | 170<br>+/+ | 92*<br>+/-  |
|      | 0<br>-/+   | 4341<br>-/- |

4,603 samples

PPA= 100%

NPA=98%

\*Samples required discrepant analysis- see below chart.

Over a three month period 4,603 BBL CHROMagar MRSA plates were read in parallel between APAS and manual reading. 262 samples were called presumptive positive by APAS. Manual reading confirmed 170 of these to be true positives while the other 92 required discrepant analysis.

Results of discrepant analysis are depicted in Fig. 3. Interestingly, 3% of the discrepant presumptive positives called by APAS were true MRSA missed by manual reading.

Time motion studies determined a 10% reduction in technologist time per week (data not shown).

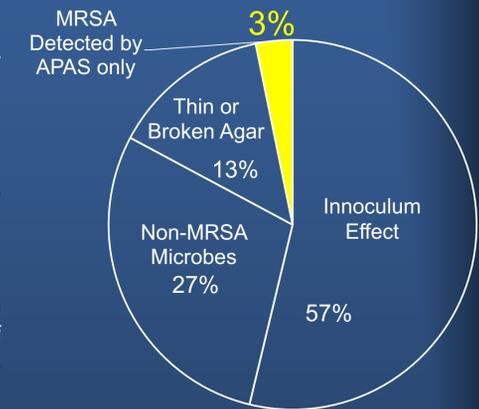


Figure 3: Breakdown of Discrepant Analysis Results

## Conclusions

- Compared to manual reading, the APAS demonstrates high accuracy and detected low-level positives missed by manual reading.
- In a laboratory with a moderate volume of cultures (70 per day) modest gains in technologist time are realized.
- Greater efficiencies may be realized in a high throughput laboratory with a large number of MRSA cultures and or larger menu of chromagar surveillance cultures.
- Efficiency would be further enhanced if the Independence software was interfaced with the LIS for auto-reporting.