DEPARTMENT OF PATHOLOGY AND LABORATORY MEDICINE
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ABSTRACT

Determination of maternal *Streptococcus agalactiae* (Group B Streptococcus [GBS]) colonization is prior to labor and delivery is paramount for guiding appropriate intrapartum antimicrobial prophylaxis. Since the introduction of active GBS prevention, the incidence of early-onset (i.e., within 1 week following birth) neonatal GBS disease has declined by 80% (1). A key component of successful GBS disease prevention is detection of this opportunistic pathogen by analyzing maternal-vaginal rectal swabs obtained within weeks 35 and 37 of gestation (3, 5). Prior to the advent of GBS molecular diagnostics, the majority of surveillance depended upon isolating GBS from enrichment broths derived from vaginal-rectal swabs. Despite its relatively high sensitivity, selective culture is slow, requiring up to 48 hours for result reporting. Although this slow turnaround time is tolerable for routine surveillance, it is unsatisfactory when a result is needed much sooner.

Currently, there are several molecular GBS testing platforms that are approved for use in either as research-use-only systems. These systems employ nucleic acid amplification or nucleic acid probes for detecting GBS-specific genetic determinants in either enrichment broths and/or directly from patient specimens. Depending upon the needs of the laboratory, systems are able to perform single tests if test volumes are relatively low or, for those with higher test volumes, multiple tests simultaneously. In addition, the hands-on time (HoT) of these assays vary from long to short, the latter accounting for the almost total involvement of automation. Despite these differences, each assay platform is reported to have very high analytical sensitivities and specificities.

Among the factors to consider when purchasing GBS testing systems, the HoT and total TAT are important since most laboratories are staffed by scientists who are required to carry out numerous tasks throughout their workshifts. In laboratories that process large volumes of GBS specimens, test systems that offer relatively hands-free usage and provide high sample throughput often help mitigate the effects of laboratory staffing shortages and increased workload burdens, respectively. For example, the ARIES+® (Luminex Corp., Austin, TX) and illumigene® Group B Streptococcus (Meridian, Cincinnati, OH), and the Xpert® GBS Assay (Cepheid, Sunnyvale, CA) are in-scope unless invalid results were obtained. In these cases, testing was repeated once more. All testing was performed according to the manufacturer’s specifications.

In our study, we were interested in determining both the HoT and the total turnaround time (TAT, HoT plus automation time [AT]) for a variety of GBS testing systems that included both more and less labor-intensive systems. We evaluated the temporal aspects of testing with each of 4 systems (BD MAX™ GBS, Luminex ARIES+® GBS, illumigene® Group B Streptococcus, and Xpert® GBS using de-identified enrichment broth from standard-of-care testing at the IU Health Pathology Laboratory in Indianapolis, IN. For specifics regarding the analytical parameters of this study, please see the companion poster, *Comparison of Four Commercial Molecular Assays for Detection of Group B Streptococcus in Antepartum Rectal-Vaginal Swab Specimens Following Broth Enrichment*. 

• **Clinical specimens**
  - A total of 209 de-identified, remnant antepartum rectal-vaginal swab enrichment broths were enrolled in this study.
  - Patient age range: 16 – 42 years (median, 27 years).
• **Standard-of-care testing**
  - Upon receipt by the IU Health Division of Clinical Microbiology, vaginal-rectal swabs (Liquid Stuart medium; BD, Sparks, MD) were broken off into Lim broth (BD, Sparks, MD) and incubated for 18 – 24 h at 37°C in ambient air.
  - Following incubation, 15 µl aliquots of well-mixed Lim broth from each swab were tested by the BD MAX™ GBS assay (BD, Sparks, MD) using the BD MAX™ System as per the manufacturer’s specifications.
• **Comparator assay testing**
  - Following standard-of-care testing, remnant Lim broths were stored at 4°C until testing by comparator methods.
  - All samples were tested within 48 h of BD MAX™ GBS testing.
  - Aliquots of remnant Lim broths were tested using the ARIES+® GBS Assay (BD, Sparks, MD) using the BD MAX™ System following the manufacturer’s specifications.
  - Aliquots of remnant Lim broths were tested using the ARIES+® GBS Assay (BD, Sparks, MD) using the BD MAX™ System as per the manufacturer’s specifications.
• **HoT and TAT analyses**
  - A set-up, run initiation, analytical, and post-analytical times were measured.
  - HoT was evaluated for individual samples as well as when 6 and 12 samples were run simultaneously.
  - Because the illumigene® system can only accommodate a maximum of 5 samples at once, 2 instruments were used and a total of 3 runs were performed in order to accommodate Group B Streptococcus detection. The data from these runs were combined.
  - The total TAT was calculated by adding the HoT and AT.

RESULTS

- HoT and total TAT are presented in Figures 1 and 2, respectively.
- HoT for 1, 6, and 12 samples:
  - For single samples, the total HoT for all assays was less than 5 minutes (range) and ranged from 1:05 min (ARIES+® GBS and Xpert® GBS) – 3:32 min (illumigene® GBS assay).
  - The BD MAX™ GBS assay had a HoT of 3:05 min.
- For 6 samples ran simultaneously, HoT ranged from 4:45 min (ARIES+® GBS) – 1:41 min (illumigene® GBS assay)
  - The Xpert® GBS and BD MAX™ GBS assays had HoT of 7:25 min and 3:22 min, respectively.
  - For 12 samples ran simultaneously, HoT ranged from 8:42 min (ARIES+® GBS) – 9:07 min (BD MAX™ GBS).
  - The Xpert® GBS and illumigene® GBS assays had HoT of 14:00 min and 18:25 min, respectively.
- Total TAT for 1, 6, and 12 samples:
  - The ARIES+® GBS assay had total TAT for 1, 6, and 12 samples of 1:56:43 h, 3:57:40 h, and 2:04:08 h, respectively.
  - The BD MAX™ GBS assay had total TAT for 1, 6, and 12 samples of 3:32:33 min, 1:01:41 h, and 2:03:23 h, respectively.
  - The Xpert® GBS assay had total TAT for 1, 6, and 12 samples of 5:59:01 min, 2:04:44 h, and 1:09:39 h, respectively.

CONCLUSIONS

- The ARIES+® GBS assay required the least total HoT for testing 1, 6, and 12 samples while the illumigene® Group B Streptococcus assay required the most HoT when testing these 1, 6, and 12 samples. 
- The fastest total TAT for 1 and 6 samples was seen with the illumigene® Group B Streptococcus assay and the fastest total TAT was recorded with the Xpert® GBS assay for 12 samples. The slowest total TAT was seen with the BD MAX™ GBS assay when 12 samples were tested.
- All systems tested produced actionable results much sooner than conventional selective bacterial culture making molecular GBS testing an ideal solution for GBS surveillance in modern clinical laboratories.
- Please see the companion poster, *Comparison of Four Commercial Molecular Assays for Detection of Group B Streptococcus in Antepartum Rectal-Vaginal Swab Specimens Following Broth Enrichment*, for details regarding assay performance characteristics.

REFERENCES