Workflow Comparison of Automated Analyzers for Infectious Disease Testing

Abstract

While the widespread use of vaccines has markedly decreased the global occurrence of measles, mumps, rubella, and varicella-zoster (MMRV) viruses, recent changes in public perception regarding vaccine efficacy and declining vaccination rates have altered population immunity, resulting in an uptick in localized outbreaks.[1–4] These developments have increased the demand for MMRV serologic testing within clinical laboratories, where personnel shortages and limited resources underscore the necessity for streamlined and effective testing workflows. This case study compares two diagnostic workflows for MMRV testing, using observational time-and-motion studies conducted at two independent laboratories. Workflow efficiency was assessed based on daily operating time and composite metrics that include startup, maintenance, analyte testing, and resulting activities. The findings revealed differences in total operating time and manual labor, providing insights to guide decisions on laboratory result throughput, staffing, and resource optimization.

Background

Understanding a patient's immune status is important for mitigating the risk of transmitting vaccine-preventable diseases (VPDs). Demand for immune status testing may fluctuate for multiple reasons, including localized outbreaks and changes in clinical screening practices. MMRV IgG serology testing is commonly performed as a multi-test panel, requiring laboratories to perform four separate tests to assess immune status. Managing multiple individual assays within a single testing panel introduces operational complexity, particularly for laboratories processing higher testing volumes. Handling separate reagents, test configurations, and result workflows for MMRV may contribute to increased analyzer and technologist demands. These factors can also influence staffing allocation and overall turnaround time in routine clinical operations. This study compares the operating time of two diagnostic analyzers used for MMRV serologic testing to assess workflow efficiency.

Methods

Two observational workflow studies were conducted at large clinical laboratories in the central United States—one affiliated with an academic medical center and one within a multihospital health system—to evaluate the BioPlex™ 2200 System (Bio-Rad Laboratories, Inc.) and the LIAISON XL System (Diasorin).

The LIAISON XL System uses a chemiluminescence method that requires separate tests for each analyte. The BioPlex 2200 System uses a multiplex method, enabling all individual MMRV analytes to be tested in a single test using one reagent kit. An independent workflow consultant measured duration times for setup, calibration, analyte testing, and maintenance tasks, capturing both manual labor time and analyzer processing time. Data were collected during routine analyzer use over multiple days at each site and averaged for analysis. The test volumes used in this study reflect MMRV testing volumes from a representative clinical laboratory (Table 1).

Table 1. Testing volumes from a representative clinical laboratory.

MMRV Analyte	Monthly Test Volume
Measles IgG	450
Mumps IgG	365
Rubella IgG	411
Varicella-zoster IgG	608

Results

The duration times for startup, maintenance, analyte testing, and resulting activities for both instruments are summarized in Table 2. Each activity includes manual labor and analyzer processing times.

The BioPlex 2200 System had a total operating time of 2 hr 41 min per day, compared to 4 hr 26 min for the LIAISON XL System.

Table 2. Total operating time per day (hh:mm).

Workflow Activity	BioPlex 2200 System	LIAISON XL System	Reduction
Startup	01:28	01:40	–12%
Maintenance	00:18	00:28	–36%
Analyte testing	01:04	02:30	–57%
Resulting activities	00:01	00:03	–67%
Total operating time	**02:41**	**04:26**	–39%

Table 3 shows the manual labor times for startup, maintenance, analyte testing, and resulting activities for both instruments. The BioPlex 2200 System had a total manual labor time of 35 min per day, compared to 1 hr 17 min for the LIAISON XL System.

Table 3. Manual labor time per day (hh:mm).

Workflow Activity	BioPlex 2200 System	LIAISON XL System	Reduction
Startup	00:22	00:37	–41%
Maintenance	00:09	00:14	–36%
Analyte testing	00:04	00:24	–83%
Resulting activities	00:01	00:03	–67%
Total operating time	**00:35**	**01:17**	–55%

Discussion

The BioPlex 2200 System completed the evaluated MMRV workload in 39% less total operating time than the LIAISON XL System (Table 2). Manual labor time accounted for much of this reduction, with the BioPlex 2200 System requiring 55% less manual labor time (Table 3). Time savings were observed across startup, maintenance, analyte testing, and resulting activities.

Of all workflow activities, analyte testing showed the greatest time differences: the BioPlex 2200 System required 57% less total time (Table 2) and 83% less manual labor time (Table 3) than the LIAISON XL System. This difference was due to the BioPlex 2200 System's multiplex methodology, which processes all four MMRV analytes in a single test. By contrast, the LIAISON XL System requires separate tests for each analyte, adding manual processes and extending analyzer run times.

For the remaining workflow activities, the BioPlex 2200 System required 12% less startup time, 36% less maintenance time, and 67% less resulting activities time (Table 2), driven primarily by reduced operational requirements. Its multiplex reagents enable the use of a single reagent pack, calibrator set, and control set for all MMRV tests, whereas the LIAISON XL System requires separate reagent kits, calibrators, and controls for each test, increasing hands-on time.

While this analysis focused on workflow metrics, other factors such as assay performance, test menu reagent costs, and instrument footprint were not evaluated. Additionally, because the data were collected from two independent laboratories with differing operational practices, results may vary in other settings.

Conclusion

This study compared workflow metrics for MMRV testing on the BioPlex 2200 System and the LIAISON XL System, evaluating startup, maintenance, analyte testing, and resulting activities. Across all categories, the BioPlex 2200 System required less total operating time than the LIAISON XL System, with the largest difference observed for analyte testing time. These reductions translate into improved workflow efficiency, which may help laboratories manage higher testing volumes despite limited personnel or budget constraints, especially when demand for MMRV serological testing is increasing. By reducing daily operating time and manual labor requirements, laboratories can reallocate staff to other tasks, optimize scheduling, and improve overall operational flexibility. Further evaluation using standardized testing conditions could help confirm and extend these findings.

References

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