AUTOMATION FOR ALL

PROVING THE VALUE OF AUTOMATION IN NON-TRADITIONAL HOSPITALS

With two acute care hospitals and Kansas City's largest behavioral health program, University Health is Kansas City's only freestanding specialist and surgery center. University Health delivers nearly half of all babies born in Kansas City each year. University Health is one of only two American College of Surgeons Verified Level 1 Trauma Centers in Kansas City, Missouri. In addition to its hospital facilities, University Health has primary care clinics throughout Jackson County.

Recent awards earned by University Health are:

Forbes: America's Best Midsize Employers
For the second year in a row, recognized as 1 of 15 healthcare organizations in the midsize category.

Healthcare's Most 'Wired' for 11 Straight Years
The College of Healthcare Information Management Executives (CHIME) recognizes University Health as a Certified Level 9 in acute and ambulatory categories, assessed on adoption, integration and impact of technologies in healthcare organizations
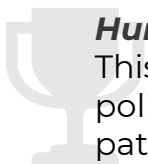
Human Rights Campaign Leader Status for 4 Years in a Row
This designation is based upon the Healthcare Equity Index (HEI) for policies and practices, ensuring equity and inclusion of LGBTQ patients, visitors and employees.

Beckman Coulter, after decades of experience, teaches laboratories several automation best practices. Implementing these learnings when a customer installs a system allows for maximum optimization to reap all of its benefits. The Beckman Coulter process consulting team evaluates each customer's workflow and mines hospital data sets to determine if the intended turnaround time goals are achieved. The data collected during University Health's evaluation complements these best practices and will be used as quantifiable evidence of their continued success.

Space Evaluation

Optimize the automation configuration to maximize productivity in the space available

Automation Ready Samples

Ensure tubes are auto-receipt "ready" for the LIS, including sample quality, label quality and label placement

Analyzer Operation Enhancement

Establish optimal maintenance, QC, and calibration times

Empower staff to use the automation; avoid front loading

Streamline Post-analytical Processes

Automate archiving for tubes to utilize auto-receive capabilities for add-on tests to existing accession numbers and promote autovalidation

Promote Hospital Communication

Invest and foster cross-department stakeholder relationships in your facilities to help build support for quality samples

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"It was important to University Health that we maximize the value of automation by connecting as many disciplines as possible, the DxA 5000 system with third-party connections automates

95%

of our laboratory's total testing volume."

Nan West
System Director of Laboratory Operations

University Health automated all their core laboratory disciplines using the DxA 5000; the laboratory has connected chemistry, immunoassay, hematology, and coagulation. The laboratory processes a peak of *2,400+* samples a day.
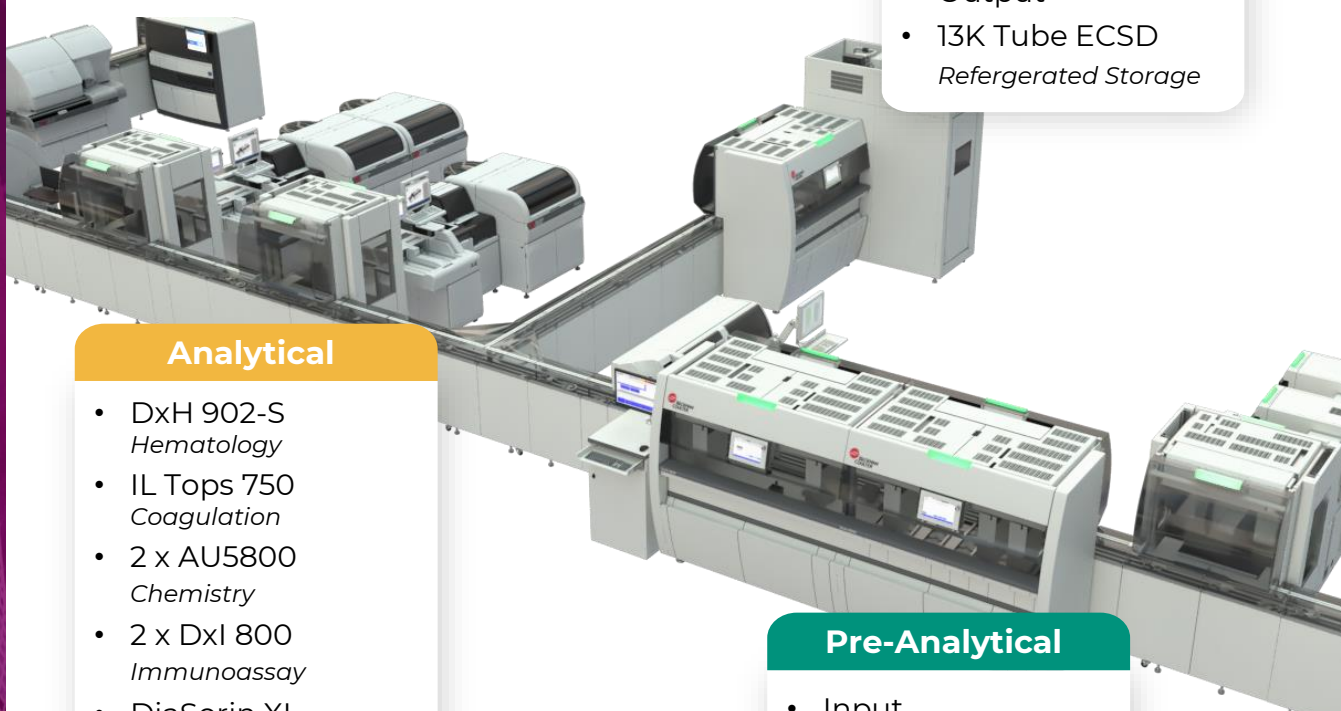
Post-Analytical

- Output
- 13K Tube ECSD
  Refergerated Storage

Analytical

- DxH 902-S
  Hematology
- IL Tops 750
  Coagulation
- 2 x AU5800
  Chemistry
- 2 x DxI 800
  Immunoassay
- DiaSorin XL
  Special Chemistry

Pre-Analytical

- Input
- Dual Centrifuge

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The Beckman Coulter process consulting team created a report combining the number of pre-analytical errors over a 7-day stint identified by the DxA 5000 system at University Health. The tube inspection unit (TIU) performs a 9-parameter sample check on each sample introduced to the input. When these errors are identified, samples are sorted into a dedicated input area for immediate resolution.

1. **Read the barcoded label**
2. **Measure sample tube size**
3. **Identify container type**
4. **Identify container cap type**
5. **Identify container cap color**
6. **Measure the fill level**
7. **Measure sample volume**
8. **Calculate sample weight**
9. **Identifies spun vs. unspun status***

After centrifugation, the same check is performed on newly spun tubes to assess that the sample meets the volume requirements for the ordered tests. It again is performed in the DxA 5000 output so that the laboratory knows how much sample volume is available for add-ons, reruns, and dilutions before storing in the environmental controlled storage device or ECSD. By calculating volume during each phase of testing, the DxA 5000 automation prevents "quantity not sufficient" samples from reaching the instruments for sampling and allows the laboratory staff to prioritize critical tests with the sample volume that is available.
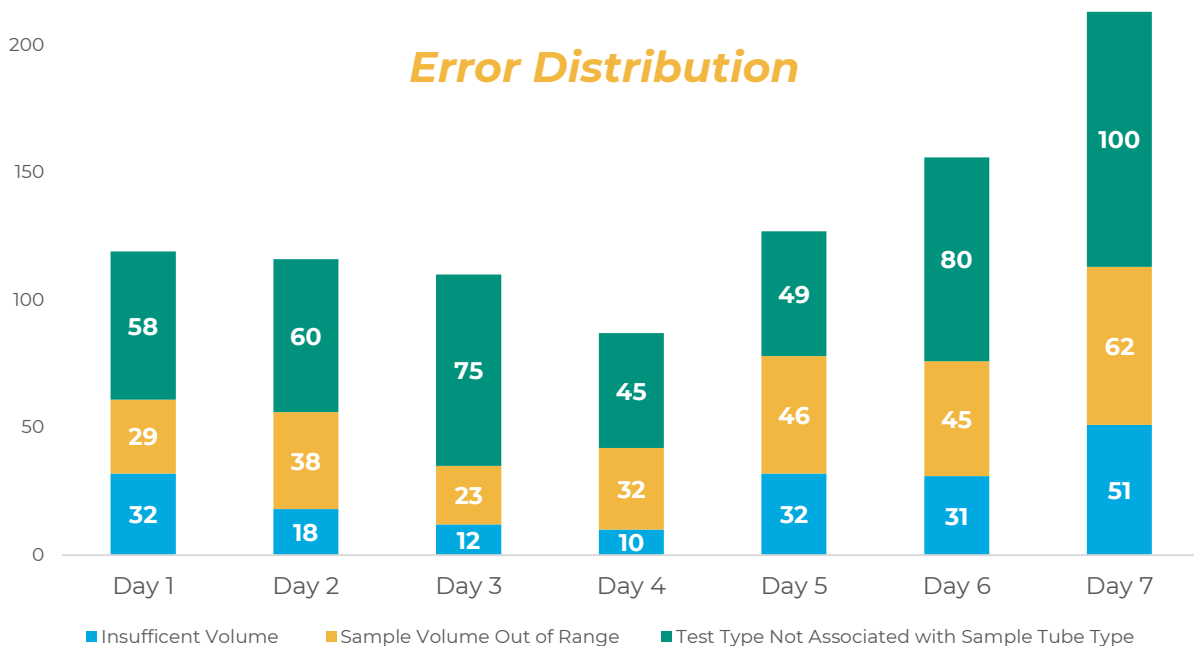
*Pre-spun status check is available for Greiner Bio-One & BD tubes.

In a 7-day evaluation, the DxA 5000 TIU identified *928 pre-analytical errors* that when recognized early save valuable time for laboratorians in unnecessary, post-analytical troubleshooting and mitigates a potential delay in physicians having access to patient results. Identification of these errors is exceptionally helpful to high turnover departments, like processing, who may miss these problematic samples during manual inspection.

Error	Total	Benefit
Test type not associated with sample tube type	**467**	Error determined that the sample type did not match the barcoded tests ordered, preventing erroneous results (ex. K+ on an EDTA sample)
Insufficient volume and sample volume out of range	**461**	Short samples were identified immediately vs. an analyzer flags the sample as QNS

" *Since the DxA 5000 provides these error details, using the information allows the laboratory to pinpoint chronic offenders of pre-analytical errors across different hospital departments; allowing for targeted training to be performed to help mitigate potential impacts to patients.* "

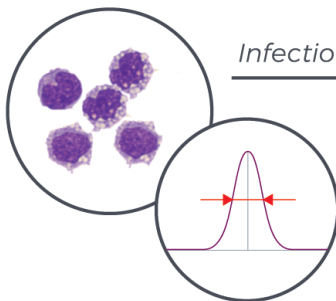**Jeffrey Kelleher MBA, BS, MLT (ASCP)**
Core Laboratory Supervisor

Error Distribution

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Test Type Not Associated with Sample Tube Type	58	60	75	45	49	80	100
Sample Volume Out of Range	29	38	23	32	46	45	62
Insufficent Volume	32	18	12	10	32	31	51

■ Insuffecent Volume   ■ Sample Volume Out of Range   ■ Test Type Not Associated with Sample Tube Type

*Pre-spun status check is available for Greiner Bio-One & BD tubes.

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As part of the ***Analyzer Operation Enhancement*** best practice, the team can evaluate success based upon turnaround times, tube distribution between like analyzers, and tech utilization of the automation metrics. Since University Health automated all core laboratory departments, this study provides data for chemistry, immunoassay, hematology and coagulation. Turnaround times are crucial metrics that all laboratories monitor to ensure that test results are being delivered to the physicians efficiently.

Using the DxH 900 hematology analyzer, University Medical Center was the first hospital in North America to validate and utilize Monocyte Distribution Width (MDW). MDW is the only regulatory-cleared hematological biomarker that helps to establish severity of infection and risk of sepsis in adult patients in the emergency department. MDW is included in all emergency department complete blood count (CBC) orders. By measuring MDW's turnaround time, it provides a holistic view of how quickly the laboratory is reporting hematology samples.
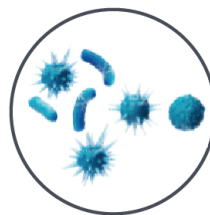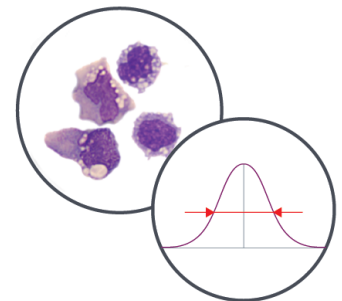
NORMAL MONOCYTES   **BACTERIA, VIRUS, FUNGI**   **ACTIVATED MONOCYTES**

Infection

Immune Dysregulation

Monocyte sizes
INACTIVE MONOCYTES – NORMAL MDW

Monocyte sizes
ACTIVATED MONOCYTES – ELEVATED MDW

CBC with Monocyte Distribution Width (MDW)
Turnaround Times

Average TAT	*9.50*
Standard Deviation	*8.58*
90th Percentile	*18*

DxH Slidemaker Stainer II

DxH 900

DxH 900

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Below are other important tests and turnaround times at University Health. Each of these assays require serum or plasma and the times below include all pre-analytical work and centrifugation performed by the DxA 5000 input module.

High Sensitivity Troponin (hs-TnI)
Turnaround Times

Average TAT	*32.05*
Standard Deviation	*6.71*
90th Percentile	*35*

Potassium (K+)
Turnaround Times

Average TAT	*26.19*
Standard Deviation	*6.44*
90th Percentile	*30*

Activated Partial Thromboplastin Time (APTT)
Turnaround Times

Average TAT	*24.08*
Standard Deviation	*10.80*
90th Percentile	*35*

Coagulation Utilization
Percentage of samples tested by the connected ACL Tops:

92%

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By having a high utilization rate, it ensures the intelligent routing of the DxA 5000 automation and REMISOL Advance that samples are evenly distributed among all connected analyzers. The chemistry instruments receive the highest volumes of samples and below are the AU5800 instruments' distribution. Sharing of the workload in this manner is important for instrument reliability, system performance, and patient turnaround times. All the metrics outlined are critical in capturing the highest rate of return.

Total Tube Distribution in Chemistry

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
AU5800 2	369	314	148	178	321	406	335
AU5800 1	298	297	214	174	298	363	345

■ AU5800 1   ■ AU5800 2

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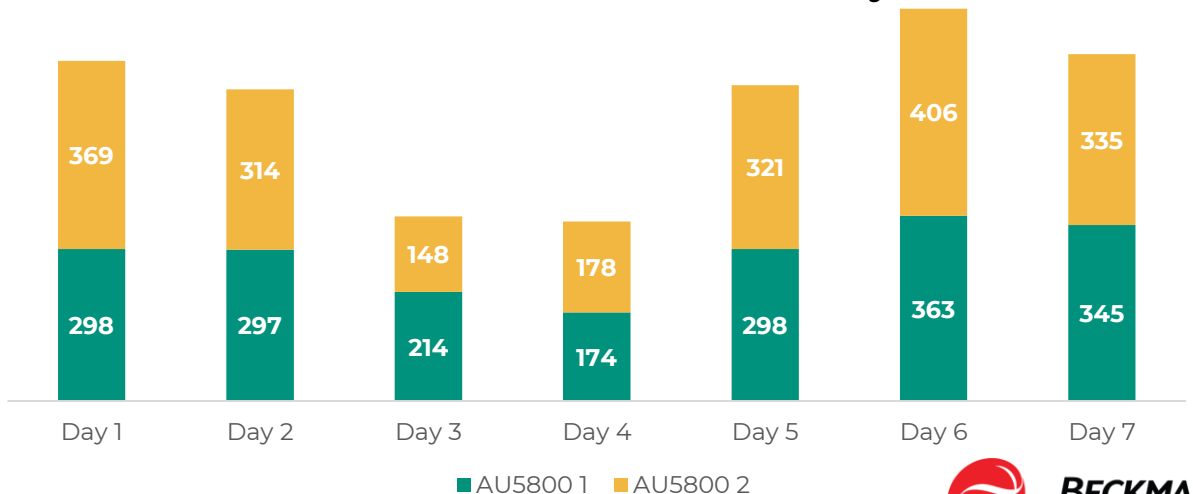
Another key aspect of post-analytical work in laboratories is using middleware tools to further optimize workflow and network standardization. At University Health, all instruments connected to the automation are all interfaced with REMISOL Advance.
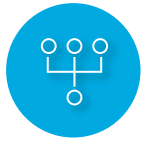
> "REMISOL Advance, as a middleware solution, allows our laboratory to have the autonomy to write, test, and move rules into a production environment independently and in real time. In conjunction with the automation, REMISOL Advance has automated our add-on process, requiring no technologist intervention, with the following benefits:

1 **Reducing processing time**

2 **Reducing waiting time for add-on orders ultimately reducing turnaround times**

3 **Mitigating the risk of mislabeling samples associated with a manual process**"

Jeffrey Kelleher MBA, BS, MLT (ASCP)
Core Laboratory Supervisor

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Learn more about Beckman Coulter's Monocyte Distribution Width (MDW)
https://www.beckmancoulter.com/en/blog/diagnostics/monocyte-distribution-width

Learn more about Beckman Coulter's automation portfolio
https://www.beckmancoulter.com/en/products/automation

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