Case Study

Hořice Hospital

In the fast-paced environment of modern clinical laboratories, efficiency and precision are paramount. Laboratories constantly seek innovative solutions to ensure accurate results, streamline workflow, and reduce turnaround times. This case study examines how the Beckman Coulter DxC 500i Clinical Analyzer (DxC 500i) integrated chemistry and immunoassay system streamlines laboratory operations, saving time and enhancing overall efficiency.

This evaluation took place in Hořice, a town located 130 km northeast of Prague, Czech Republic, and has approximately 10,000 inhabitants. Hořice Hospital is one of the smaller clinical labs in the Czech Republic and is running approximately 100 tubes a day, but it faces the same challenges as other larger hospitals these days; increasing volume of samples, increased pressure on quality and, demand to decrease turnaround time (TAT). The laboratory's management recognized the need for a more efficient system to handle the growing workload without compromising accuracy.

To address these challenges, Hořice Hospital decided to test and implement the Beckman Coulter DxC 500i Clinical Analyzer into their workflow. This study shows the analytical workflow efficiencies and time savings when moving from two separate analyzers (AU480 Chemistry Analyzer and Access 2 Immunoassay System) to an integrated DxC 500i analyzer. The laboratorian ran a series of 10 samples with 16 ordered tests on both standalone systems, AU480 Chemistry Analyzer and Access 2 Immunoassay System, and compared those samples with the newly installed DxC 500i system. **Table I** shows representative results of the measurements. Ordered assays on the chemistry module were ISE (Sodium, Chloride and Potassium), enzymes (ALT and AST), Calcium, Magnesium, Urea, Total Bilirubin, Glucose, Total Protein, and CRP Latex.
On the immunoassay module, HCG5, hsTnI, free T4 and TSH3 assays were completed.

40% Reduction
in Turnaround Time for Test Results

Date	Analyzer	Loading time	First completed result	Last completed result	Total Time
12.3.2024	Access 2 Immunoassay System	10:29	11:29	11:48	134 min (both analyzers)
13.3.2024	AU480 Chemistry Analyzer	15:57	16:12	16:53	
13.3.2024	DxC 500i Clinical Analyzer	14:07	14:56	15:28	81 min

Protocol:

Table 1 presents results from the comparison experiment of two standalone analyzers with an integrated system. The series contains 10 patient samples with 16 ordered tests (10 chemistry and 4 immunoassay). Key details include: Date – the date of the measurement; Analyzer – the type of analyzer used; Loading time – the time when the rack was loaded into the appropriate analyzer; First completed result – the time of the first completed patient sample after loading the rack; The same set of 16 tests were run across three separate analyzers as follows: for the standalone Access 2, a rack of 10 tubes with 4 tests ordered; For the standalone AU480, a rack of 10 tubes with 12 tests ordered; For the DxC 500i, two racks with 7 and 3 tubes, and a total of 16 tests (12+4) ordered – the same 16 tests were run across the 3 separate analyzers; Last completed result – the time when the last result of the final sample was received; Total time – the duration from loading the rack to receiving the final result.

Analysis:

As seen from the results, the implementation of the DxC 500i analyzer brought about significant improvements in the laboratory's analytical workflow and overall efficiency. First, the laboratory experienced a **40% reduction in turnaround time for test results**, (81 vs. 134 min). The DxC 500i system delivered patient results 53 minutes sooner than standalone chemistry and immunoassay instruments combined. Second, the DxC 500i sample handler, facilitated by the use of shared/combined test tubes, reduced the manual workload of technicians, allowing them to focus on more complex tasks.Third, the integrated system reduced the need for multiple instruments and consumables, resulting in cost savings for the laboratory. Finally, the DxC 500i analyzer is designed to deliver high-quality performance in clinical chemistry and immunoassay testing with its Six Sigma chemistry assays.

Maintenance procedures are often time-consuming processes that can impact workflow and turnaround time (TAT). When a lab uses standalone analyzers, the staff can schedule maintenance for each analyzer at their convenience. This flexible scheduling allows them to measure patient samples on one analyzer while performing maintenance on another simultaneously. With the new integrated analyzer, this advantage of standalone analyzers is retained. Thanks to the special FlexMode Operations function, it is possible to continue measuring samples on one module while maintenance is being conducted on another, creating flexibility for the laboratorian in a busy shift.

Another approach to achieving lower TAT on the standalone analyzer could involve the staff manually aliquoting each sample. With the DxC 500i analyzer, you no longer have to aliquot each sample, minimizing errors, as manual aliquoting of patient samples introduces the possibility of human error at several stages of the process. Errors can occur during the pipetting of the sample, labeling of aliquot tubes, or even during the transfer process itself. These errors can lead to incorrect results, which pose serious risks to patient safety. Studies have shown that manual handling of samples is one of the common sources of pre-analytical errors in clinical laboratories, with error rates ranging from 0.1% to 1.8%.[1]

Additionally, the economic and environmental implications of aliquoting are significant and cannot be overlooked. Each aliquot requires a new pipette tip and a new tube. Manual aliquoting may necessitate the purchase of additional pipettes, racks, and storage solutions. While these may seem like one-time costs, maintenance and calibration of this equipment also add to the long-term expenses. In summary, the cost of aliquoting due to the cost of consumables can be substantial. In these days the environmental implications are also increasingly important. Manual aliquoting generates significant plastic waste from pipette tips, tubes, and other single-use items. According to a recently published study, the laboratory sector is a significant contributor to plastic waste, much of which ends up in landfills or oceans.[2]

In summary, integrating chemistry and immunoassay testing into a single platform enables the laboratory to provide results to the clinician more quickly, thereby improving the quality of health care they can provide. The streamlined workflow and reduced turnaround times enhance overall efficiency, allowing medical professionals to respond faster to patient needs. The case study highlights how the implementation of the DxC 500i analyzer can simplify and optimize workflows, resulting in better patient care and higher satisfaction levels.

1. Plebani M. Errors in clinical laboratories or errors in laboratory medicine? *Clinical Chemistry and Laboratory Medicine (CCLM)*. 2006;44(6). doi:https://doi.org/10.1515/cclm.2006.123

2. Rizan C, Bhutta MF, Reed M, Lillywhite R. The carbon footprint of waste streams in a UK hospital. *Journal of Cleaner Production*. 2021;286(286):125446. doi:https://doi.org/10.1016/j.jclepro.2020.125446

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