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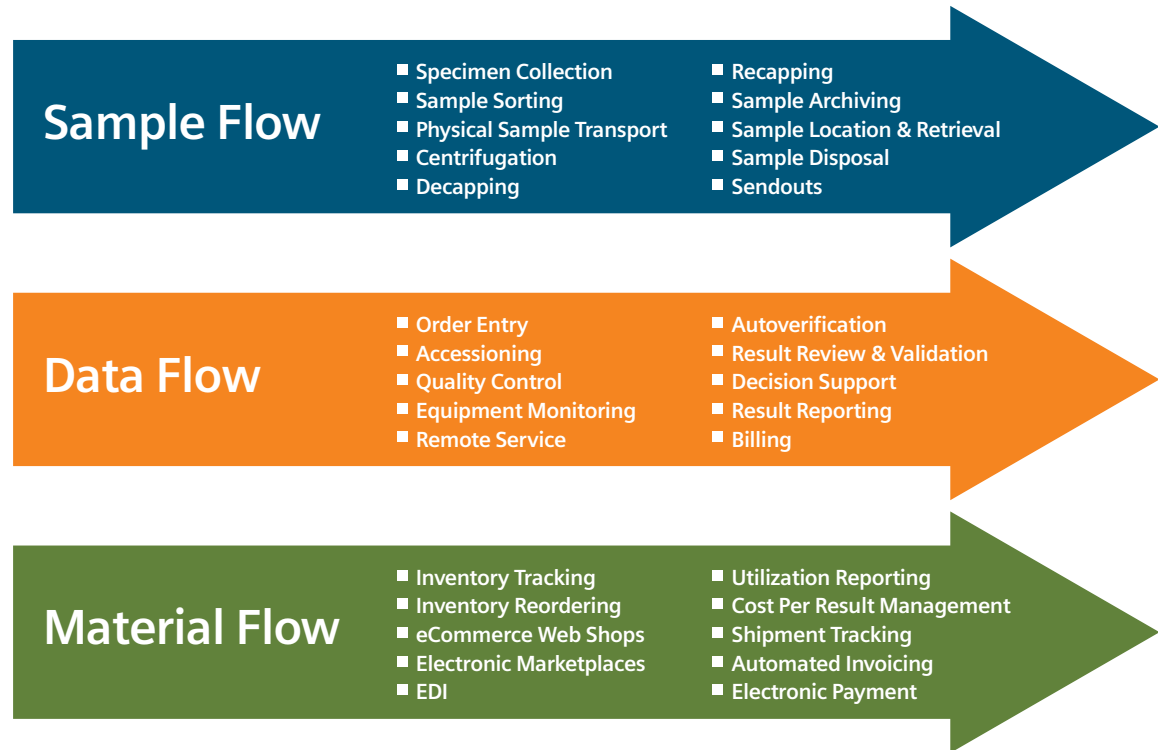breakthroughs
with IT

CentraBytes

Designing Efficient Workflows - Convergence of Lean, Automation, and IT

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Welcome to CentraBytes, a monthly tutorial on how
laboratories around the world are applying the power
of the Siemens CentraLink™ Data Management System
to improve workflow and quality.

Answers for life.

Laboratory Workflow

Sample Flow
- Specimen Collection
- Sample Sorting
- Physical Sample Transport
- Centrifugation
- Decapping
- Recapping
- Sample Archiving
- Sample Location & Retrieval
- Sample Disposal
- Sendouts

Data Flow
- Order Entry
- Accessioning
- Quality Control
- Equipment Monitoring
- Remote Service
- Autoverification
- Result Review & Validation
- Decision Support
- Result Reporting
- Billing

Material Flow
- Inventory Tracking
- Inventory Reordering
- eCommerce Web Shops
- Electronic Marketplaces
- EDI
- Utilization Reporting
- Cost Per Result Management
- Shipment Tracking
- Automated Invoicing
- Electronic Payment

Rethinking workflow

The global push toward better patient care at reduced costs is spurring new thinking in the clinical laboratory. Recognizing that actionable results are pivotal to patient management, laboratories are focusing on getting test results in the clinician's hands as quickly and as cost-effectively as possible while continuing to elevate the standard of quality. In this quest for quality and efficiency, the key is workflow—the step-by-step process that begins when the patient specimen is collected and concludes when results are delivered to the clinician. In this context, it is helpful to consider three components of workflow: processes directly related to the handling of the patient specimen (*sample flow*); processes whereby data is acquired, managed, validated, and reported (*data flow*); and the acquisition, tracking, storage, and disposal of materials such as reagents (*material flow*).

The framework

The core concepts of Lean can be applied to designing efficient workflows. This means reducing waste (identifying and eliminating elements or steps in a process that add little or no value) and streamlining processes so that work can be completed in less time and with fewer resources. Designing efficient workflows also means standardizing workflows by defining and applying uniform processes and rules for decision making. The resulting workflows often represent best practices, and errors due to inconsistencies in decisions and/or actions by individuals are reduced.

Data management is key

Designing and implementing efficient workflows go hand in hand with data management. Data is used during the workflow design process by helping to identify areas where improvements are needed. Data also guides implementation by providing feedback on the impact of new processes, enabling further improvements. For example, as the single communication link between the LIS, analyzers, pre-analytics, and automation, the Siemens CentraLink Data Management System provides ready access to the data needed to plan and implement efficient workflows.

Automated decision making enhances workflow

Taking it one step further, validated rules that ensure high-quality, accurate results can be incorporated in the data management system. This enables decisions to be implemented and actions to be taken automatically, so workflow can continue uninterrupted without the need to wait for human intervention.

Sample flow. You can automatically perform pre-analytics such as centrifugation, then direct the sample for off-track processing. This allows efficient utilization of pre-analytic capabilities on the automation track even when the test order calls for a method that needs to be performed offline.

Data flow. Another example is defining rules so that calculation tests such as estimated glomerular filtration rate (EGFR) are reflexed for patients in certain inpatient locations, such as intensive care or geriatrics.

Material flow. A third example is implementing an autodilution cascade in human chorionic gonadotropin (hCG) testing, where time and reagent savings can be realized. In the worst-case example shown here, a total of four dilutions (five tests on the analyzer) is required to generate the patient result, with a time to result of 144 minutes (Chart 1). The same four dilutions and five tests can be completed in 128 minutes by implementing rules to trigger autodilution (Chart 2). Taking this one step further, the rules can be written so that estimated hCG concentration in the patient specimen, based on the relative light unit (RLU)* of the initial result, is used to calculate the autodilution factor. This reduces the number of autodilution steps to one and the total number of tests to two. The time to result is 65 minutes (Chart 3).

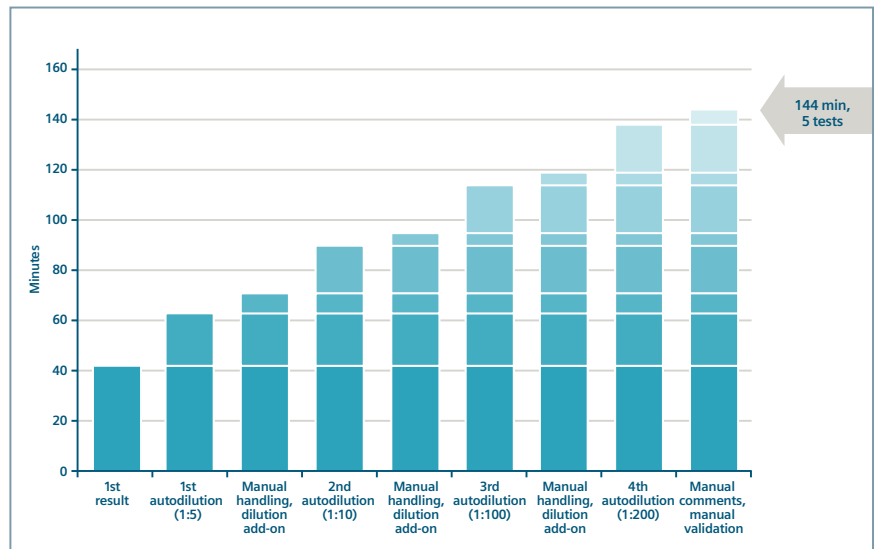**Chart 1. Before Autodilution Cascade Implementation**

144 min, 5 tests

Chart 2. After Autodilution Cascade Implementation

128 min (-11%), 5 tests
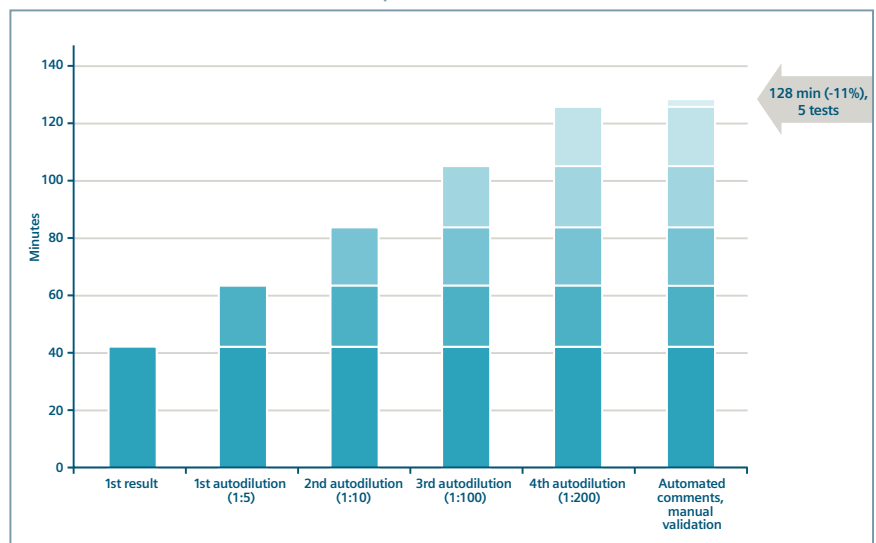
Chart 3. Enhanced Autodilution Cascade Implementation

65 min (-55%), 2 tests (-60%)
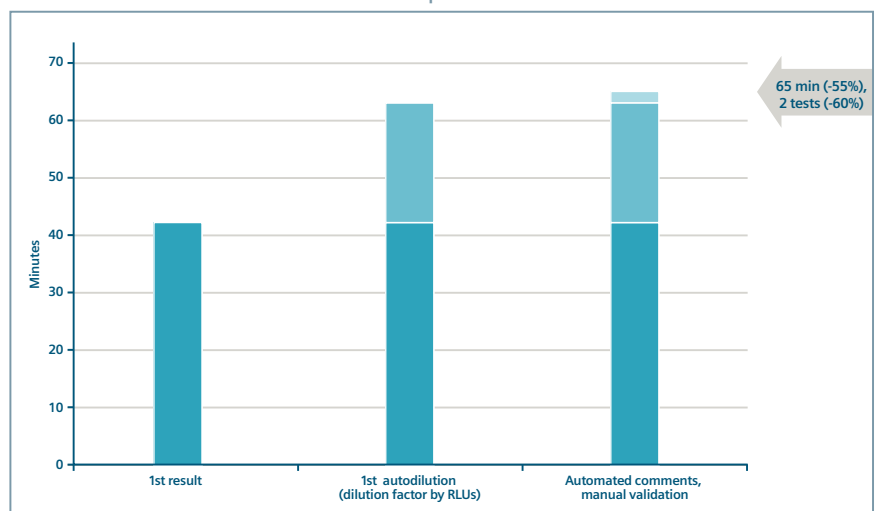
*Measurement of RLU refers to use on the ADVIA Centaur® XP Immunoassay System.

Getting there

Designing efficient workflows begins with a review and analysis of current sample flow, data flow, and material flow, along with an inventory of instrumentation and data management capabilities. The broader context of the healthcare system infrastructure, patient-management needs, and specific areas for improvement should also be considered. The focus then turns to opportunities for improvement using Lean principles, guided by an understanding of how data management can drive the new solution by providing real-time visibility of the myriad of operational details in the laboratory.

One common misconception is that introducing automation alone will improve workflow. Very often, workload outgrows the processes originally put in place. The normal reaction is to just add more horsepower. The problem can be exacerbated when a multiple-laboratory consolidation is taking place and processes from the currently largest laboratory become the de facto standard, without consideration of the specific local needs.

Several key success factors underlie efficient workflow design and implementation:

- Leverage the power of IT by integrating it in the workflow design from the beginning, not as an add-on.

- Think in terms of data flow. This helps pinpoint when decisions are needed and thus where rules can be incorporated and applied most effectively.

- Automation alone is not always the answer. To maximize the benefits of automation, make sure processes are optimized first.

- Emphasize teamwork and secure the buy-in of everyone in the laboratory.

Alistair Gammie, PhD, Global Head, Healthcare Customer Solutions (HCS), Siemens Healthcare Diagnostics, Inc, brings a solid track record in the science and business of healthcare and laboratory medicine. In addition to his doctoral degree in virology, epidemiology, and molecular techniques, Alistair is a fellow of the Institute of Biomedical Sciences and a diplomate of the Royal College of Pathology. He received Lean healthcare accreditation from the University of Michigan and is a Six Sigma Black Belt. Alistair came to Siemens 17 years ago after a 22-year tenure at the National Health Service, where his last position was as a clinical department head.

As the global head of Siemens HCS, Alistair and his team help customers visualize their future laboratory, facilitate change management, and perform health checks to make sure customers are getting the best from their systems. HCS is called upon to solve a broad range of problems, from improving TAT to multilab consolidation. Alistair finds his work most gratifying when he is able to help customers achieve their goals and, in turn, know that customers recognize the value of HCS's work, not only in conceptualizing a solution but also following through with implementation.

Alistair's day-to-day customer interface may range from the laboratory manager to the healthcare executive. In his view, the laboratory professional today is being asked to simultaneously address numerous and diverse issues, such as regulation, quality management, clinical management, personnel management, and budget. He advises new laboratory professionals to be team players, become experts in an area of interest, and surround themselves with other experts and mentors who can support their vision and career objectives.

Tiina Mäkelä, Laboratory and IT Process Consultant, Healthcare Customer Solutions (HCS), Siemens Healthcare Diagnostics, Inc. After earning her Bachelor of Science degree in industrial design and Master of Science degree in genetics, Tiina worked as a biotechnology engineer before joining Siemens 11 years ago. She received Lean healthcare accreditation from the University of Michigan.

Tiina's multifaceted training has prepared her well for the comprehensive services she provides to her customers on a day-to-day basis. She helps them plan and design workflows, provides Lean training, guides implementation, and performs pre- and post-optimization assessments to make sure the laboratory is on track to meet its goals. Very often, she assumes the role of the IT specialist, with responsibilities for controlling and monitoring processes. Tiina believes that IT offers tremendous power in process optimization, from initial assessment and design through implementation and ongoing improvement.

Tiina's customers are from central laboratories at universities and large hospitals, as well as reference laboratories. Typically, they are looking for ways to enhance processes, address productivity issues, and, importantly, eliminate errors. Very often, she works with her customers on a whiteboard as they visualize current processes, identifying steps that can be automated and tasks that can be handled using IT. Tiina believes that efficient workflows are the result of a continuous process of evaluation and improvement. She recommends that laboratories audit their own processes regularly.

Siemens Healthcare Diagnostics, a global leader in clinical diagnostics, provides healthcare professionals in hospital, reference, and physician office laboratories and point-of-care settings with the vital information required to accurately diagnose, treat, and monitor patients. Our innovative portfolio of performance-driven solutions and personalized customer care combine to streamline workflow, enhance operational efficiency, and support improved patient outcomes.

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