

## **Custom Web Applications for Continual Improvements to Laboratory Workflows**

Michelle R. Stoffel, M.D., Ph.D.; Nathan Breit; Patrick C. Mathias, M.D., Ph.D.  
Department of Laboratory Medicine and Pathology, University of Washington

### **Background:**

Busy clinical laboratories may still rely on spreadsheet-based data analysis workflows for highly specialized assays not yet compatible with standard commercial software solutions. Barriers to automating such workflows include complicated analysis requirements and processes spanning multiple software applications. While spreadsheet-based workflows are highly customizable and accessible, disadvantages include time-consuming formatting requirements, potential for copy-paste errors, and version control issues. We describe a case study of a workflow improvement using an initial cycle of focused custom software interventions as “building blocks” to attenuate several error-prone and time-consuming workflow steps, as part of a plan to eventually automate the entirety of the analysis process.

### **Technology:**

We targeted a complex immunoassay analysis workflow, working with laboratory leadership and clinical laboratory technologists to identify the highest-impact workflow steps for imminent improvement. Based on workflow analysis, two web applications were developed. One is a “lookup tool” data dashboard displaying patient data from the laboratory information system database, and allowing transfer of search results to the spreadsheet analysis workbook to replace the prior multi-step patient identification workflows. A second web application calculates a dose response curve from assay data and generates custom-formatted output which can be copy-pasted directly from the application to the workbook, eliminating multiple back-and-forth copy-paste steps between separate spreadsheet files.

### **Results:**

Preliminary analysis of workflows with the two web applications decreased the assay analysis workflow from 46 to 36 steps, a nearly 22% improvement. Furthermore, the new workflow decreases the number of data modalities/separate open files/worksheets involved from 10 to 8. Finally, while the improved workflow still involves copy-paste steps, one-step copying of the customized output from the web applications is anticipated to be less error-prone than the prior workflow involving multiple point-and-click selection of data and pasting steps.

### **Conclusions:**

Custom software applications can be used to optimize portions of a laboratory data analysis workflow with automation in a modular fashion, while allowing clinical laboratory staff to adjust to each change before moving to the next. While the ultimate goal is to move workflows away from a spreadsheet-based approach, a stepwise implementation can be a practical mechanism to achieve improvements.