RLab: A Lightweight Freezer Management System for Small Laboratories

Xenia Hertzenberg, BS[1], Ronald Shaker, BS[1] James F. Brinkley, MD, PhD[1,2,3]
[1]Departments of Biological Structure, [2]Computer Science and Engineering, [3]Medical Education and Biomedical Informatics, University of Washington, Seattle, WA

Abstract

In clinical studies, researchers must often maintain a freezer inventory of biosamples. Existing software packages, designed to track and manage freezer inventory, are not always suitable for small laboratories. We present a lightweight, low cost, alternative that's more appropriate for small studies with limited resources.

Introduction

Researchers routinely take blood and other sample types from patients during clinical visits. These samples are not immediately used, but stored in freezers, potentially at multiple locales. To keep track of inventory, technicians often use spreadsheets to log the type and location of samples. Even for studies with a small number of subjects, the use of spreadsheets can lead to complex workflows. For example, maintaining a master version of each document is required to avoid conflicting updates. Restricting document access in order to protect patient privacy requires planning and oversight. To ensure data integrity, validation of spreadsheet fields is needed. Some of the currently available freezer management systems address security, accessibility and validation (Freezerworks, CAISIS, caTissue), but many of these products have drawbacks. Expensive licensing, difficult learning curves, and complex administration often make existing solutions inaccessible to small laboratories with limited budgets.

History and Requirements

To migrate laboratories away from using spreadsheets for managing their inventories, we proposed building a lightweight tool that could be easily installed and administered by individual researchers. The tool needed to provide a web-based interface allowing user access to freezer inventory via an HTML browser. In order to promote usability and adoption, we wanted to keep the tool's scope narrow and focused on basic freezer management tasks. Because different types of clinical study data (EDC, EMR) are often stored in separate systems, our tool needed to provide an externally queryable API to facilitate export and integration of freezer data with data from other systems. To address the hurdle of licensing fees, we chose to release our freezer management tool as open source. Our first attempt to build a freezer management system for use by small laboratories resulted in creation of the Customizable Electronic Laboratory Online[1] (CELO) framework. An instance of CELO was deployed to a small laboratory at the Seattle Children's Research Institute (CRI). Users at CRI found CELO's interface less user-friendly and harder to navigate than the spreadsheets they previously employed. Based on user feedback obtained during the CRI pilot, we have designed a new freezer management system called RLab.

Current Solution

RLab is a Ruby on Rails based web application that can be deployed on multiple platforms. Ruby on Rails allows for quick prototyping of user-requested features. RLab's feature set continues to evolve through close observation of CRI's workflow. To address issues that hindered adoption of CELO, we've consolidated inventory views onto fewer screens and added more intuitive navigation and search facilities. To support auditing tasks, RLab's freezer visualization feature allows technicians to print box contents. Recognizing that spreadsheets are useful for reporting and analyzing data, we provide export facilities that give users access to their inventory data in CSV format. One of RLab's most useful features is its "clipboard" mechanism. The clipboard allows users to generate and store lists of aliquots satisfying particular search criteria. Finally, we've equipped our freezer management tool with a simple, RESTful API for extracting inventory data in XML format.

Conclusion

RLab is an affordable, easy to use alternative to commercial freezer management products. It allows multiple users access to freezer inventory data without versioning concerns and provides for both data validation and integrity checks. The application's query API makes it easy to integrate freezer data with that of other laboratory systems, providing the ability to ask queries across all of a study's data.

References

1. Fong, Christine and Brinkley, James F (2006) Customizable Electronic Laboratory Online (CELO): a web-based data management system builder for biomedical research laboratories. In *Proceedings, American Medical Informatics Association Fall Symposium*, Bethesda, MD.