An Academic-Information Technology Partnership to Create an Infectious Diseases Translational Science Database

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BACKGROUND

Translational science is the process of turning observations in the laboratory, clinic, and community into interventions that improve human health. The coordinated effort to maintain integrated, validated laboratory and clinical data is often a rate-limiting step for research laboratories, especially for multi-site studies. Previous research shows a rate of error between 2.3 and 5.2% for basic data collection in clinical databases, up to 26.9% for more complex data points. The purpose of this project was to create a translational science database prototype that would be responsive to the unmet needs of the translational research community.

MATERIALS & METHODS

Translational scientists, IT experts, and lab technicians mapped the workflow of a high-throughput research laboratory including clinical and laboratory data. Database goals were to develop processes that would minimize data entry time, avoid redundancies, and validate data in a secure environment (HIPAA-compliant). Unique to this platform was the ability to map creation of new samples (for example, PCR products) from parent samples (biologic samples). The platform was developed in an iterative process utilizing interviews, workflow study, analysis of supporting artifacts, and mock-ups.

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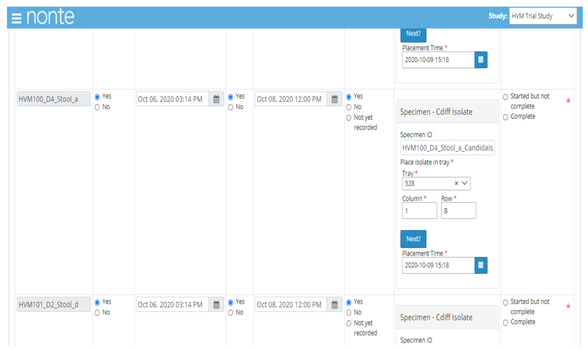
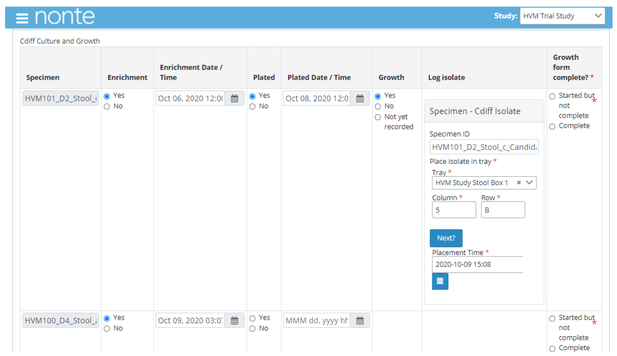
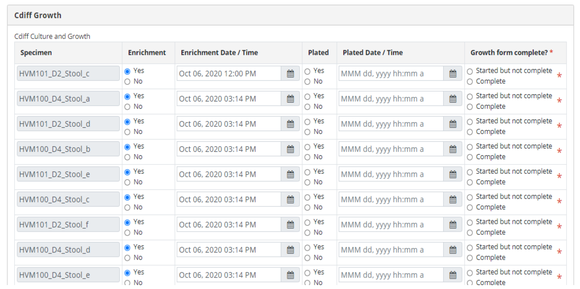
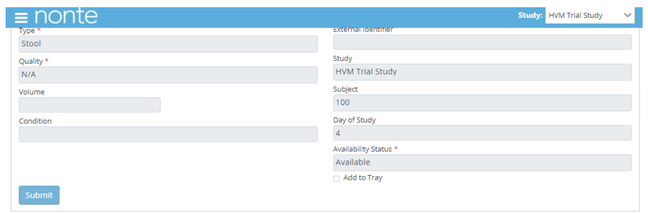
RESULTS

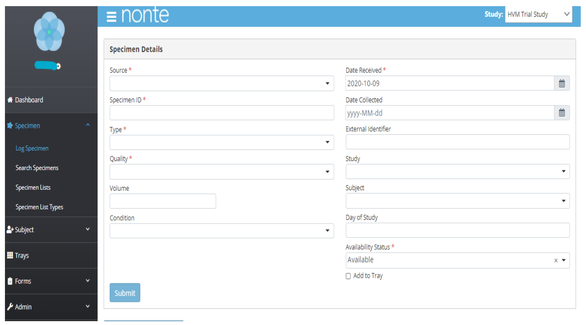
Figures 1-6. Examples of Workflow

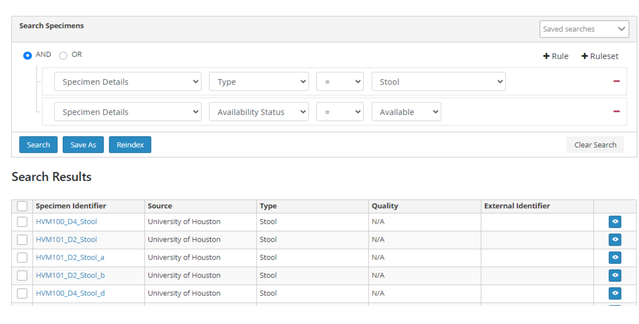












Beginning from the top. Figure 1. Capture the process of placing an isolate or sample into a tray. Trays can be configured to accommodate different types of boxes and alternative storage solutions. Figure 2. Capture the process of running an assay. In this example a sample is being enriched for bacterial isolation. Figure 3. Process an entire box or tray of samples at one time. This enables processes to be batched together mirroring the bench-side process. Figure 4. View one specimen's details, from this form you can assess the current data points associated with this sample. Figure 5. Entering a specimen or sample into the system. This form is customizable for different study needs. Figure 6. The search function is flexible and amendable as more searchable data points are loaded into the screen. There is no limit to the parameters you can search by.

The current prototype allows for electronic upload or manual data entry of clinical data. In a small controlled study we found the rate of error for basic data entry to be below 1% within it. Pre-populated data entry screens map laboratory work-flow with custom data entry fields produced based on laboratory results earlier in the work flow. Work-flow mapping includes microbiology, phenotypic descriptions (MIC), molecular biology (PCR), and customized experiments. Sequence data, housed separately, has data linkers stored in the database. The launch screen and data entry forms are populated based on specific criteria entered for each user.

Table 1. Breakdown of benefits

Populus System	Traditional
Web-based / browser-based – no desktop software to install	Software and Hardware installs may be needed.
Cloud-based - always on, accessible anywhere and scalable to millions of records	Hard drive storage or additional cost for cloud storage
Customizable Forms to match process/workflow and study data dictionaries	Finite options for forms and workflow capture
Rich, dynamic search capability	Search limited by software parameters
Database changes are tracked and auditable	No audit trail available
Multi-user, collaborative	Single user per instance, overwriting risk

CONCLUSIONS

The Translational Science Database allows for efficient capture of high-quality data with baseline validation enabling seamless linking of translational data for single or multi-site laboratories. Future development work will expand the number of experiments and also incorporate stored biobank information into the database.