A Wayfarer’s Guide to the Galaxy

LabKey Inside the NIHR Oxford Biomedical Research Centre
What is the NIHR BRC?

• NIHR
  • National Institute for Health Research

• BRC
  • Biomedical Research Centre

• Collaboration between
  • NHS Foundation Trust Oxford University Hospitals
  • University of Oxford

• Clinical Informatics Team
Oxford Hepatology Research Project
What is it?

• Data collection for patient care and research
• Used by the Hepatitis Clinic in Oxford
• LabKey Study with 37 datasets across 6 cohorts
• Built in 2015 to use the Date/Visit style of Study
• In 2019 updated study to use the Continuous style
What did we do?

• Designed a custom JavaScript UI to sit on top of the LabKey UI
• Designed in 2015 with the assistance of LabKey
• Uses LabKey’s JavaScript API
• Originally built using JavaScript and jQuery

• With the new LabKey UI we are currently rebuilding our interface using React to hopefully make it even smoother
Why did we do it?

• Easier use for front-line medical staff as an EPR
• Allowed clear viewing of existing data
• Made it easier for adding/editing patient data
• Allows the researchers to use the inbuilt LabKey study functionality
  • Connections for R Studio
  • Searching
  • Charts & Reports
Viewing Patient Data
### Data Views

**Name**
- Clinical Assessment
  - Risk Factors
    - Hepatitis C Risk Factors
    - Hepatitis B Risk Factors
    - Hepatitis D Risk Factors
    - Hepatitis E Risk Factors
    - Cirrhosis Staging
    - Social History
    - Pregnancy
    - Clinical Coding
  - Diagnosis
    - Hepatitis C Diagnosis
    - Hepatitis B Diagnosis
    - Hepatitis D Diagnosis
    - Hepatitis E Diagnosis
    - Autoimmune Hepatitis Diagnosis
    - HIV Diagnosis
    - HCV Re-Infection
    - Co-Morbidities

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### Participant Data

<table>
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<tr>
<th>Participant ID</th>
<th>Date of data collection</th>
<th>Alcohol Use Status</th>
<th>Ever Been Heavy Drinker (i.e. Males &gt; 21 units/week, Females &gt; 14 units/week)</th>
<th>Current Weekly Alcohol Intake</th>
<th>Smoking Status</th>
<th>Smoker Start Year</th>
<th>Smoker End Year</th>
<th>Cigarettes Per Day</th>
<th>Lifetime Pack Years</th>
<th>Ever Injected Drugs</th>
<th>Year Of First Injection</th>
<th>Injected In Last Six Months</th>
<th>Cannabis Usage Status</th>
<th>Cannabis Start Year</th>
<th>Weight (kg)</th>
<th>Height (cm)</th>
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<td>08 Dec 2016 / 08 May 2015</td>
<td>Past/Former No</td>
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<td>2010 No</td>
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<td>Yes</td>
<td>2010 No</td>
<td></td>
<td></td>
<td></td>
<td>61.9</td>
<td>166.0</td>
</tr>
</tbody>
</table>
Custom LabKey UI
Adding/Editing Patient Data
Laboratory Test Results
The Problem...

• A standard EPR will usually be connected to the laboratory test system/s

• LabKey is not...

• However it can be!!
The Solution

- Use of a LabKey ETL (Extraction, Transform & Load)
  - Extract all participants into a “Subject Of Interest” (SOI) table outside of LabKey

- Use our Clinical Data Warehouse
  - To provide master patient ids for each subject, updating the SOI table
  - To populate a laboratory test table with all laboratory tests for all the subjects

- Use of a LabKey ETL
  - Merge all the laboratory tests into the LabKey laboratory study dataset

- This is run automatically on a daily basis
The Process
Health Informatics Collaborative (HIC): Hepatitis Theme
What is happening?

• Data sharing agreements in place between participating NHS Trusts
• Data from participating HIC centres is submitted by XML into the Oxford Data Acquisition & Management System
• Processed by Oxford’s MeRCURy application which validates, dimensionalises and stores all submitted data
• All data stored in a custom designed database for the theme in question
How are we using LabKey?
Data Submission

• LabKey’s “files”

• Allows users to “drop” files in for submission at any time

• Allows users to see any files submitted to review inconsistencies between stored data and submitted data
Data Viewing

- LabKey’s “external schemas”
- Read-Only connections to databases outside of the LabKey database
- Customisable grid/tabular views of tables
- Custom queries (finally) of these databases
- Connectivity using external analytics e.g. R
- Exporting custom data to common formats
Welcome to the Hepatitis Core

All data can be seen using one of the tabs.

If all the tabs aren't visible please use the drop-down in the first tab.

Relationships

Please note that the following relationships exist.

Study Subject

One to One
- Death
- Demographics
- Discharge
- Enrolment HCV UK
- Liver Transplant

Many to One
- Cirrhosis Stagings
- Comorbidities
- Diagnoses
- HIV Diagnoses
- Hospital Visits
- Imagings
- Liver Biopsies
- Pregnancies
- Referrals
- Risk Factors
- Social Behaviours
- Non-Viral Medications (found with Treatments)
- Treatments
- Laboratory Tests

Treatments

Many to One
- Side Effects
- Anti-Viral Medication

Diagnoses

Many to One
- Hepatitis B Genotypes
- Hepatitis C Genotypes
- Hepatitis D Genotypes
- Hepatitis E Genotypes
Most Importantly!

• Everything is audited
• Everything is controlled by group level access
• No-one has direct access to the database
• This is accessible across the NHS N3 network allowing true data sharing between NHS Trusts without the data ever being available to the world
Managing Multiple LabKey Deployments
Instances

• Hepatology Research Project
• Health Informatics Collaborative
• Clinical Data Warehouse Data Products
• OUH Patient Safety System
• Ovarian Cancer Research
• OCCAMS ICGC Project
• And a few more ...
Docker

• Container based & OS independent
• Deployed using docker-compose
• 2 Containers both built using Alpine OS
  • PostgreSQL
  • Tomcat/LabKey
• Internal network between containers so entirely secure
• Easily & quickly updateable
  • Change the version in the Dockerfile
  • Call “docker-compose up -d”
Thank You