Hidden Microbiome of Infection Surveillance Culture Program and the Living µBiome Bank

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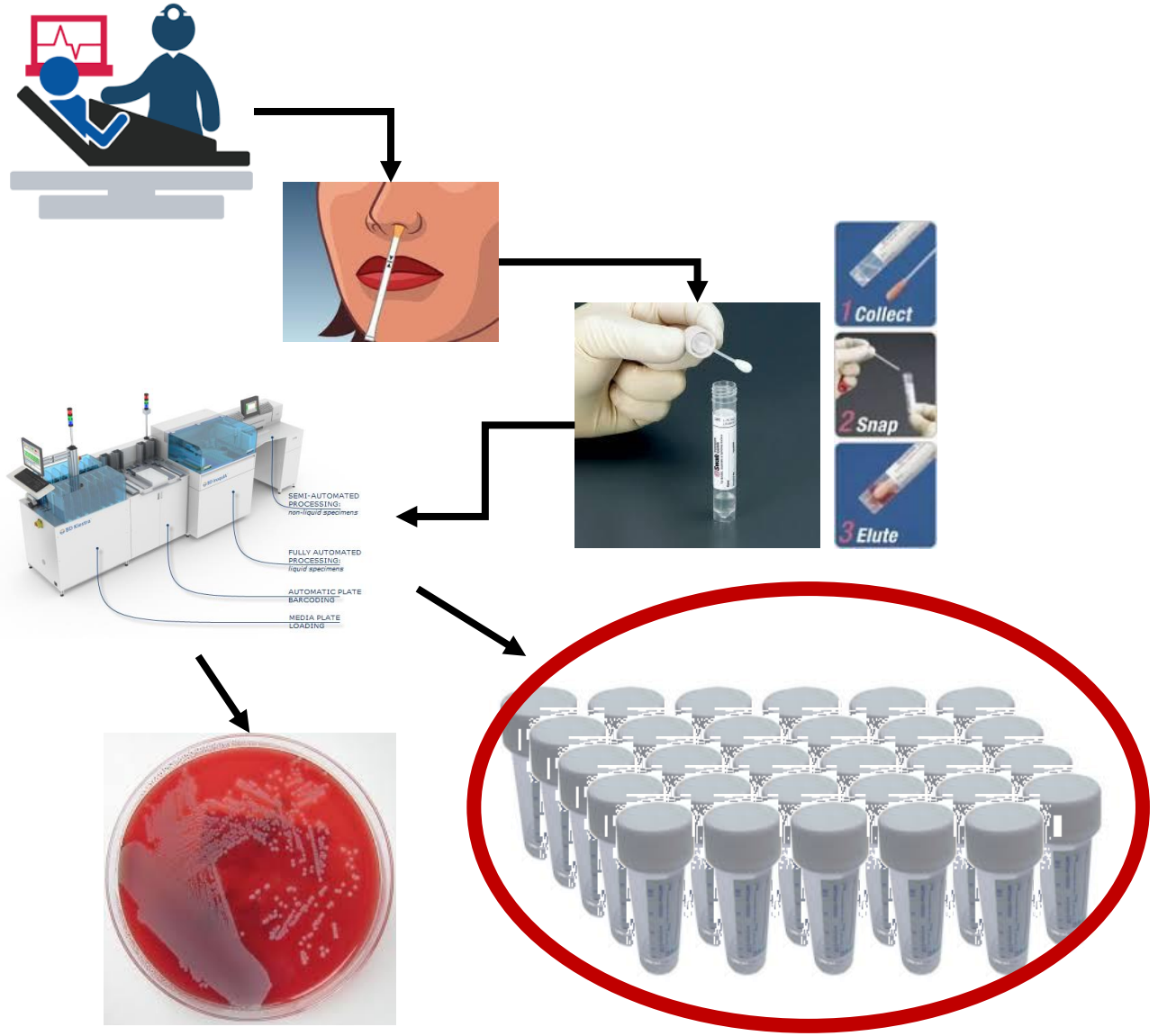
MUSC Hospital Active Infection Surveillance culture program

- Every inpatient admitted to the hospital is subject to the program
- Swabs for MRSA and VRE are obtained as soon as possible after admission
- Samples are processed within 24-48 hours to determine colonization
- BD auto-streaking instrument is used to minimize bias
- **75% of the specimen volume remains in excess and is discarded within a week of collection**



Number of specimens processed by MUSC Diagnostic Microbiology Lab (DML) in a typical month

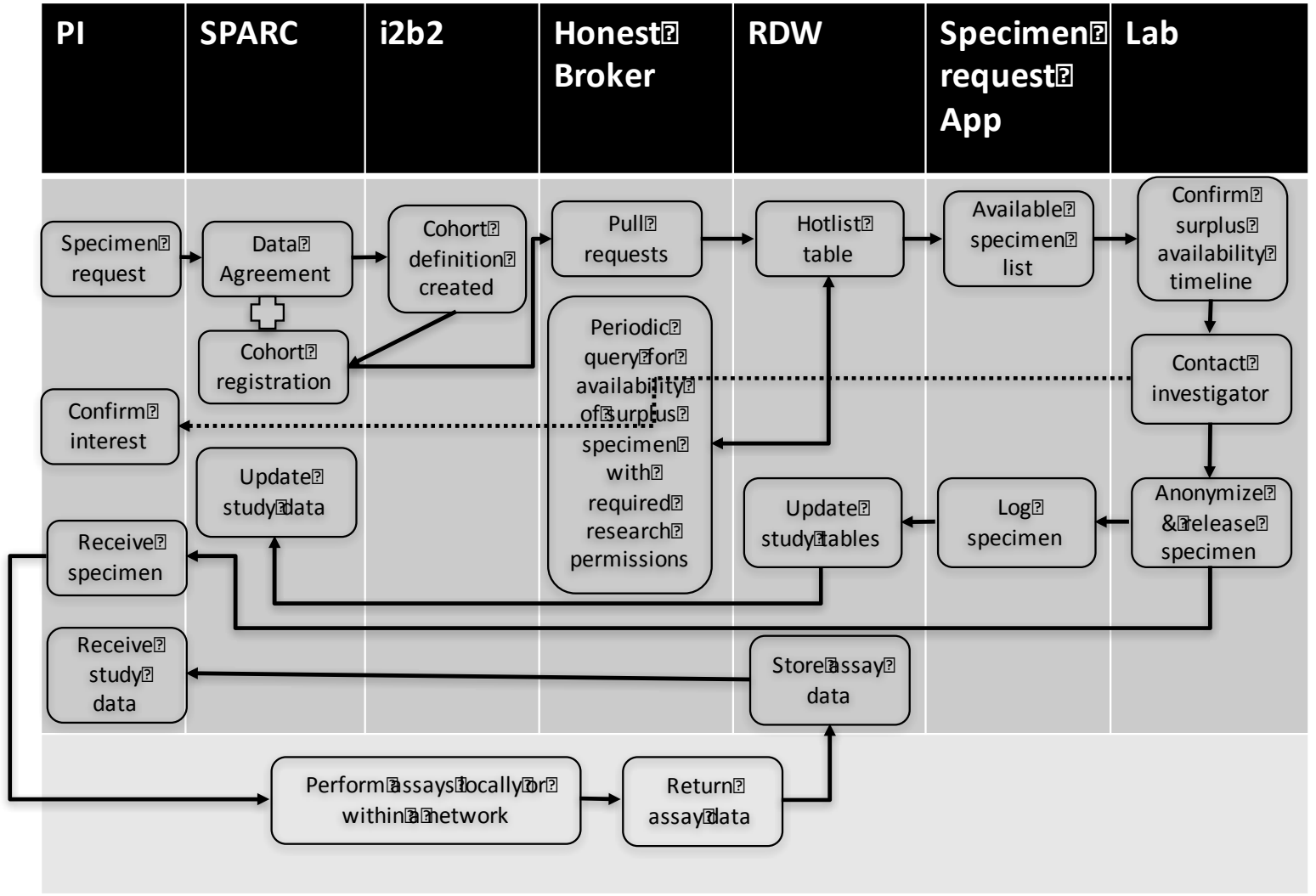
N/month	Specimen description
2,584	Urine in BD preservation tubes* or sterile containers
2,472	MRSA surveillance Eswabs**
2,379	VRE surveillance Eswabs**
501	Wound Eswabs**
364	Lower respiratory specimens in sterile containers
170	Vaginal/rectal Eswabs** for Group B Streptococcus
160	Stool submitted for *C. difficile* PCR in sterile containers
147	Stool submitted for G.I. PCR Panel in sterile containers
105	Tissues, frozen at -70C for 1-2 months
52	Sterile body fluids

Vision: The surplus materials from active infection surveillance program will be used for translational research at MUSC

Why focus on infection surveillance culture program specimens?

- **Sampling uniformity**
  - Only a few trained nurses are assigned to collect the swabs, minimizing the collection bias.
  - Sample handling is automated, minimizing handling bias.
- **Participation reach**
  - All subjects are subject to the program.
  - MRSA swabs are collected from almost every subject.
  - VRE swabs collected from select units (surgery, etc.)
- **Impact potential**
  - Specimens are collected early in the course of providing care.
  - Specimens are collected throughout care provision timeline.

Preliminary Living µBiome Bank Workflow



Preliminary RDW schema for microbiome

Abundance Table	
SpecimenID* (Mult)	
OTUID* (Mult)	
OTUCount	Number of times OTU has been seen in this sample

Sample Data Table	
ResearchID** (Mult)	Alpha/Numeric
SpecimenID** (Mult)	Alpha/Numeric
BatchID*	Sequencing analysis batch
CollectionDate	Date
ProcessingDate	Date
Body site	Text (e.g. Nasal
Lab ID	text (who collected the sample)
TestType	Text (MRSA/VRE
TestOutcome	positive, negative, inconclusive

Batch Table	
BatchID*	
ExtractionProtocol	
SequencingType	WMGS, 16S
BatchDate	Date
FileRef	Location of raw sequences

OTUID Table	
OTUID**	
NCBITaxaID*	
RefSeq	Exact sequence representing this OTU

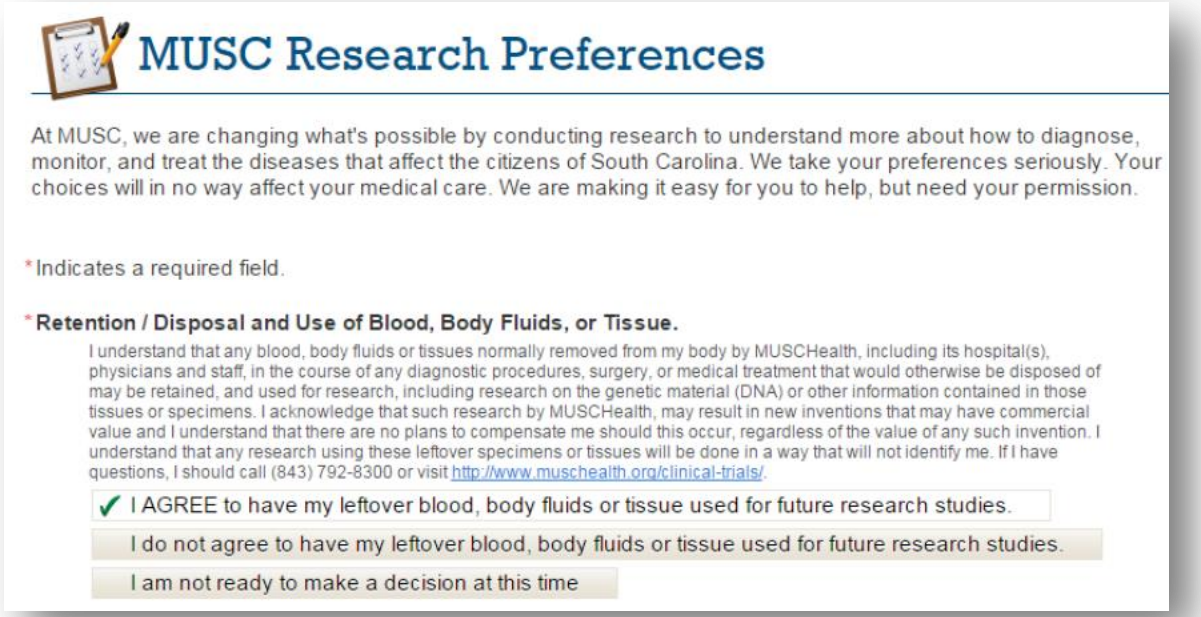
NCBITaxa Table	
NCBITaxaID**	Unique identifier for the taxon
Domain	e.g. Bacterium
Phylum	e.g. Firmicutes
Class	e.g. Bacilli
Order	e.g. Bacillales
Family	e.g. Staphylococcaceae
Genus	e.g. Staphylococcus
Species	e.g. Aureus
Strain	N/A
Isolate	N/A

Immediate Goals

- Goal 1: Determine the suitability of surplus surveillance testing material for microbiome analysis.
- Goal 2: Determine feasibility of obtaining the excess specimens from DML in a de-identified way.
- Goal 3: Establish the infrastructure for storage of massive amounts of patient microbiome data in RDW.
- Goal 4: Perform proof of principle pilot research studies on these specimens.
- Goal 5: Provide a system for ordering de-identified microbiome specimens from precisely defined patient cohorts within and outside MUSC.
- Goal 6: Determine the utility of microbiome biomarkers in predicting patient visit health outcomes.

Consent challenges

- We will use research preferences collected routinely in EHR
- Patients are invited either via Patient Portal or during encounter
- However there are limitations…



MUSC Research Preferences

At MUSC, we are changing what's possible by conducting research to understand more about how to diagnose, monitor, and treat the diseases that affect the citizens of South Carolina. We take your preferences seriously. Your choices will in no way affect your medical care. We are making it easy for you to help, but need your permission.

*Indicates a required field.

***Retention / Disposal and Use of Blood, Body Fluids, or Tissue.**

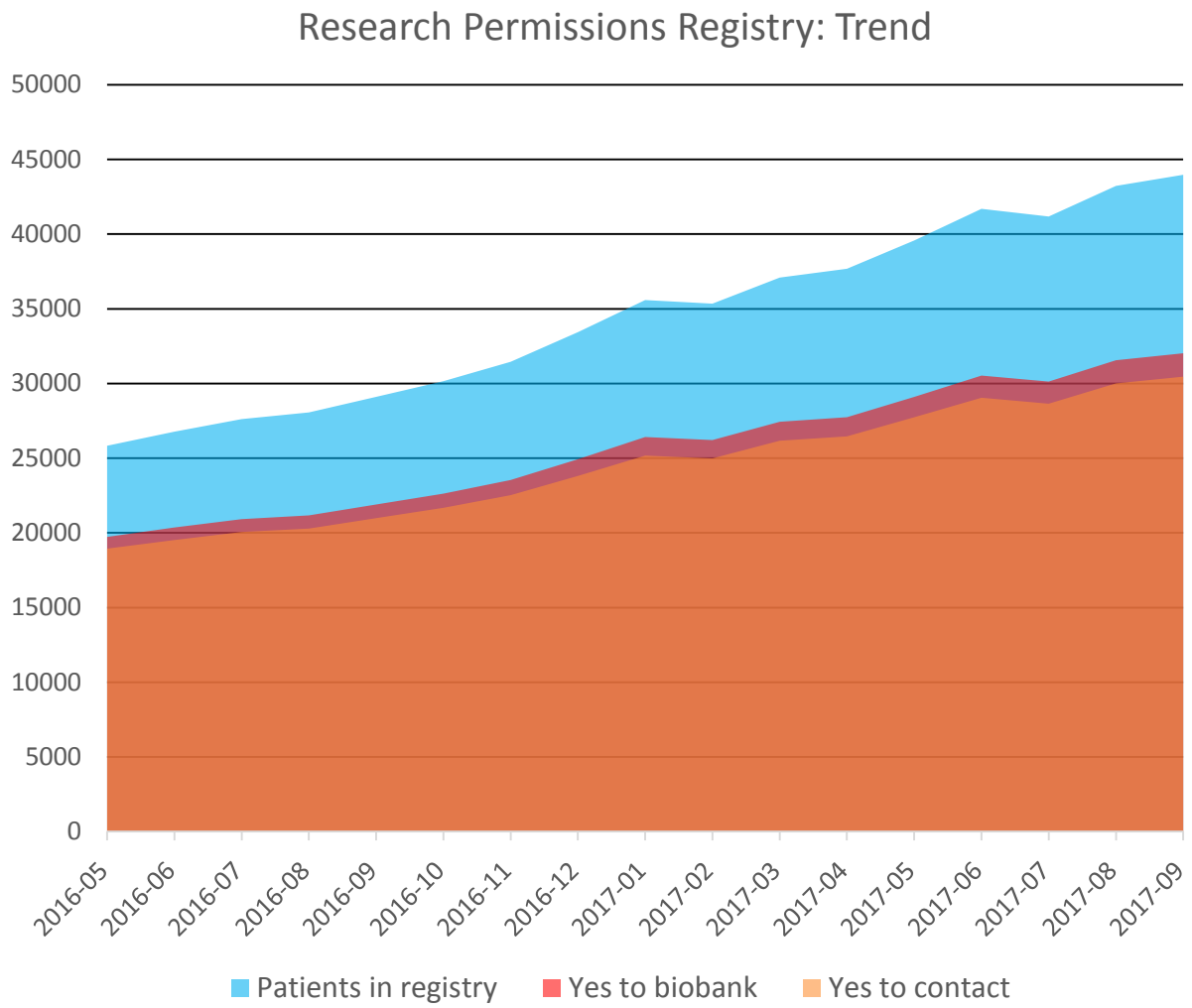
I understand that any blood, body fluids or tissues normally removed from my body by MUSCHealth, including its hospital(s), physicians and staff, in the course of any diagnostic procedures, surgery, or medical treatment that would otherwise be disposed of may be retained, and used for research, including research on the genetic material (DNA) or other information contained in those tissues or specimens. I acknowledge that such research by MUSCHealth, may result in new inventions that may have commercial value and I understand that there are no plans to compensate me should this occur, regardless of the value of any such invention. I understand that any research using these leftover specimens or tissues will be done in a way that will not identify me. If I have questions, I should call (843) 792-8300 or visit http://www.muschealth.org/clinical-trials/.

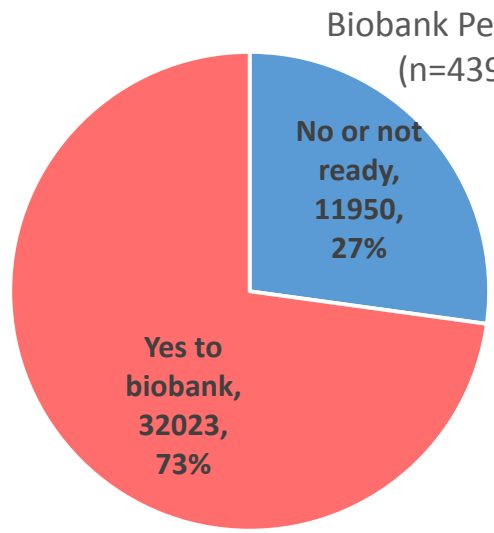
✓ I AGREE to have my leftover blood, body fluids or tissue used for future research studies.

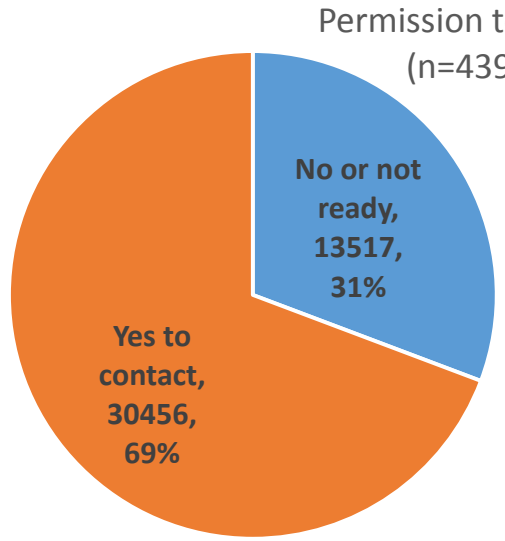
I do not agree to have my leftover blood, body fluids or tissue used for future research studies.

I am not ready to make a decision at this time

Research Preferences



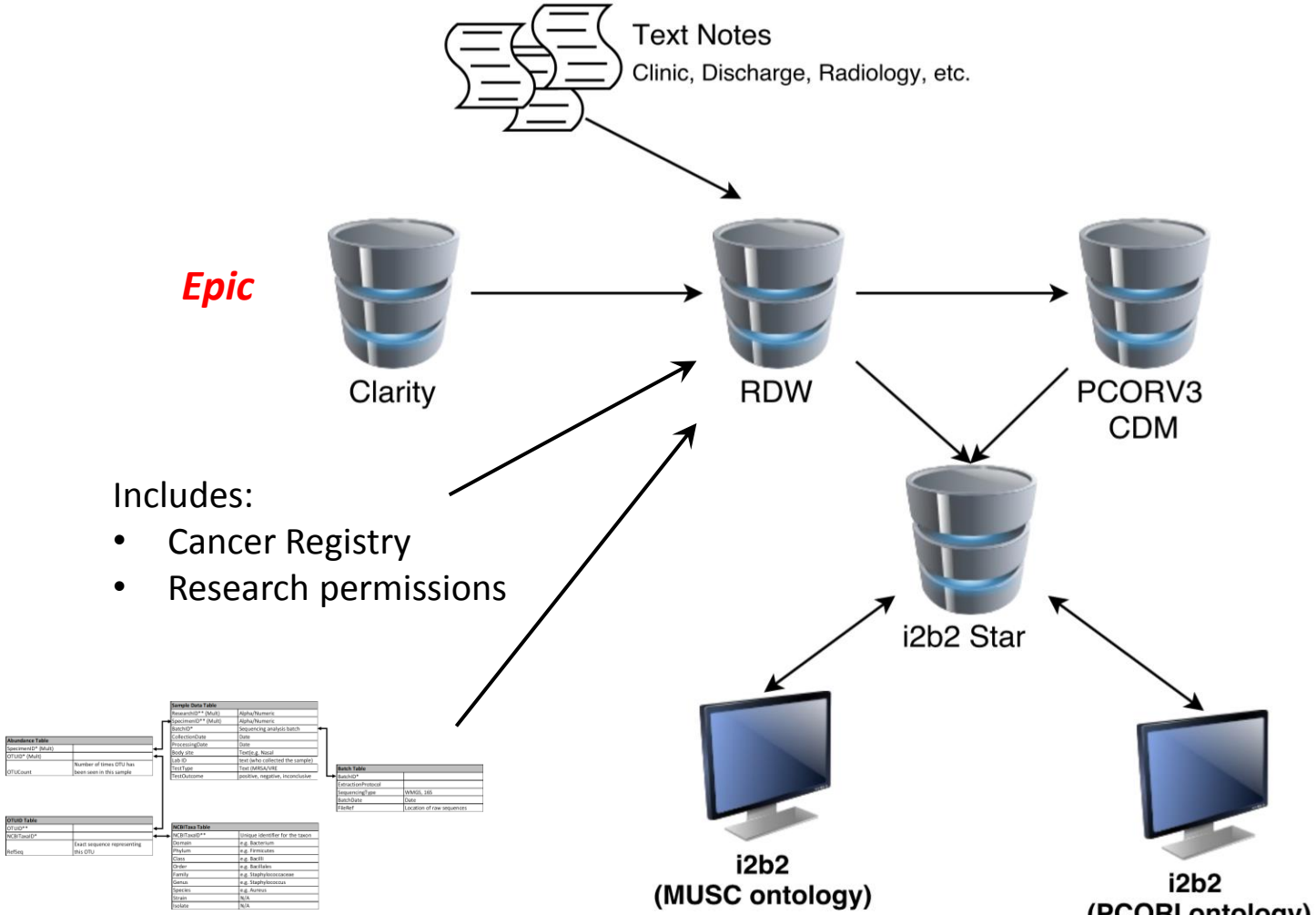




Consent challenges (continued)

- Less than 15% of patients have answered the MUSC Research Preferences questionnaire
- We will exclude those who do not agree to have their leftover specimens for future research studies
- **What about the other 85% of patients who have not answered the questionnaire?**

Research Data Warehouse



Microbiome data (linked using research ID)

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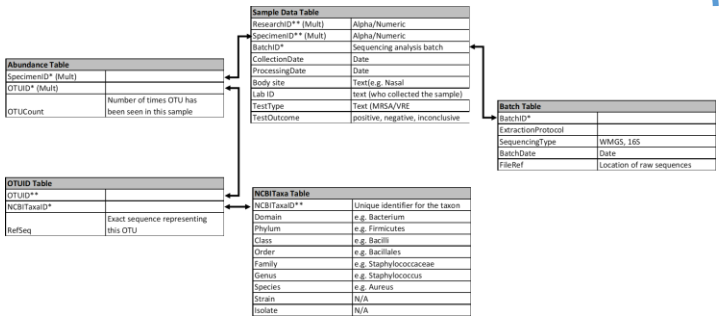
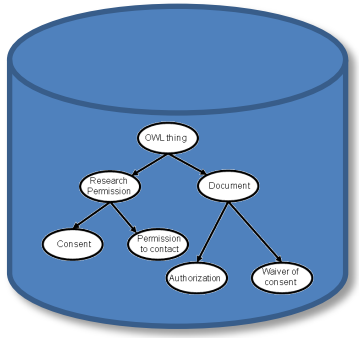
Microbiome data repository (in RDW and beyond)

RDW

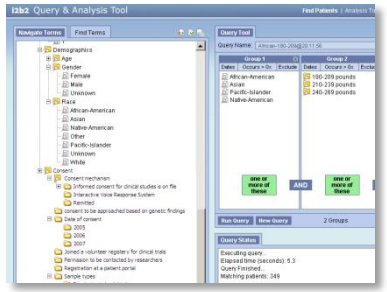


Microbiome data

OHMI
(DOID)
OBIB



Query ontology



i2b2 Workbench

Data Sharing & Analysis

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