Database & Methods Cyberseminar Series

Using CDW Microbiology and Pharmacy Data in Outcomes Research

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Database & Methods Cyberseminar Series

- Informational seminars to help VA researchers access and use VA databases.
- Topics
- VA data sources & data access systems
- Application of VA data to research and quality improvement questions
- Limitations of secondary data use
- Resources to support VA data use
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FY ‘17 Database & Methods Schedule
First Monday of the month*  1:00pm-2:00pm ET

Visit our Education page for more information & registration links.
www.virec.research.va.gov
Today’s objectives

• To provide an overview of VA CDW Microbiology and Pharmacy domains
• To provide examples of how specific data elements can be used for research questions
• To describe limitations and strengths of these data
Acknowledgments

- Office of Information and Technology
- Veterans Informatics and Computing Infrastructure
- Office of Informatics and Analytics
- Christopher Nielson, Reno VA
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- Linda Poggensee, Hines VA
- Katie Suda, Hines VA
- Margaret Fitzpatrick, Hines VA
- VA HSRD CDA 10-030 funding for Makoto Jones
- VA HSR&D, RR&D Services
- VA QUERI CARRIAGE
Agenda for Presentation

- Overview of Microbiology and Pharmacy domains
- Two examples
- Limitations and strengths
- Other Resources
Poll #1: About you

• What is your role in VA research?
  • Research Investigator/PI
  • Data Manager/Analyst
  • Project Manager/Coordinator/Assistant
  • VA Program Office or Operations Staff
  • Other (please specify)
Poll #2: Your experience with microbiology data

What is your experience with CDW Lab Microbiology data?

- Not worked with it at all
- I have worked with CDW Micro 1.0, but not the latest version (Micro 2.0)
- I have been working with CDW Micro 2.0 but I am a novice
- I am beyond a beginner in using CDW Micro 2.0 data
What’s new in Microbiology 2.0?

• Microbiology 1.0 was the first available national data set on select microbiology data (since Summer/Fall 2012)
  • Only included bacteriology
  • Only included organisms with antibiotic susceptibility test results
    • Difficult to determine negative cultures

• Microbiology 2.0 became available in 2015 and includes more microbiology test data:
  • Includes organisms without susceptibilities
  • Virology
  • Mycology
  • Parasitology
  • Does not include mycobacteriology organisms
What does Lab Microbiology 2.0 include?

• Individual-level data from VistA microbiology package on the test and result
• Data from 10/1/1999 - present is available and updated regularly
• All microbiology data
  • Variables of interest include free-text fields (e.g. ‘Organism’ or ‘CollectionSample’)
  • Variable interpretation of data model by facility, resulting in differences in where microbiologic data are stored
  • Examples of tests that may be stored in different places (ie. PCR tests, antibody tests)
  • Examples of organisms that may be found elsewhere (ie. Clostridium difficile, methicillin-resistant Staphylococcus aureus (MRSA) identified by nasal swabs via PCR)
Lab Microbiology 2.0 Sample Schema

DIM TABLES “Supporting” tables

FACT TABLES “Parent” tables

There are several more fact tables, including Micro.Mycology, Micro.Parasitology, etc. All of these tables link to Micro.Microbiology using MicrobiologySID
Micro.Microbiology

• Contains data on all the specimens collected that are located in the Microbiology subsection of VistA
  • Previously, only bacteriology, but now includes virology, parasitology, etc.

• Specimen date and time information (e.g. collected, received, reported), accession, station

• Patient and staff unique identifiers (e.g. ‘PatientSID’)

• Additional variables include foreign keys (FK) that link to associated microbiology tables or dim tables

• ‘MicrobiologySID’ is the primary key (PK)
  • A unique count of this ID gives you the number of microbiology cultures for the time frame and cohort
Dimension Tables

- There are many dimension or dim tables linked to Lab Microbiology
  - Antibiotic, Organism, Topography, CollectionSample, etc.
- Can be viewed without a cohort, because they do not contain any sensitive information (e.g. ‘PatientSID’)
  - Can be viewed in VINCI in the folder named CDWWork
- Schema for dimension tables is Dim, e.g. Dim.Organism
Examples of data use

- Surveillance of select bacterial infections/colonization or drug resistance

- Risk factors, processes of care, treatment, and outcomes for select bacterial infections/colonization or drug resistance
Poll #3: Your pharmacy data experience

- What is your experience with CDW Pharmacy Domains data?
  - Not worked with it at all
  - I have worked with CDW pharmacy domains but I am a novice
  - I am beyond a beginner in using CDW pharmacy domains
Pharmacy domains

- Production – Updated Nightly
  - Pharmacy Bar Code Medication Management (BCMA) – inpatient
  - Pharmacy Outpatient
  - Pharmacy Patient
  - Purchase Care (formerly fee)
Pharmacy domains

- Raw – Updated every 3 months
  - RxUD (Unit Dose)
  - Intravenous Meds (IV)
  - May help with medications that you might anticipate would be in BCMA but are actually not
Example of a Pharmacy Domain
Pharmacy Bar Code Medication Management (BCMA) Schema

https://vaww.cdw.va.gov/metadata/Reports/ERDiagramsOfViews/Pharmacy%20BCMA_4352.jpg
Example Variables of Interest

- LocalDrugSID
- DrugNameWithDose
- DaysSupply
- DoseOrdered (dosage amount, ie. 250)
- Unit (ie. mg)
Agenda for Presentation

• Overview of Microbiology and Pharmacy domains

• Two examples

• Limitations and strengths

• Other Resources
Examples for data use

• **Example 1**: Assessing antibiotic resistance in microorganisms

• **Example 2**: Antibiotic treatment/exposure
Example 1: Assessing antibiotic resistance in microorganisms
Overview of Microbiology hierarchy

A unique count of MicrobiologySID gives you the number of all microbiology cultures for the study cohort and time frame.

A unique count of MicrobiologySID gives you the number of bacteriology cultures for the study cohort and time frame.
Micro.AntibioticSensitivity

- Includes a subset of specimens from Micro.Bacteriologyreports
  - Only positive cultures that had antibiotic susceptibility testing performed
  - Includes variables that identify the antibiotic tested against and the antibiotic sensitivity results and interpretation
    - Examples: S-susceptible, I-Intermediate, R-Resistant
Overview of Microbiology hierarchy

A unique count of MicrobiologySID gives you the number of all microbiology cultures for the study cohort and time frame.

A unique count of MicrobiologySID gives you the number of bacteriology cultures for the study cohort and time frame.

A unique count of MicrobiologySID gives you the number of bacteriology cultures with antibiotic susceptibility testing for the study cohort and time frame.
Dim.Organism and Dim.Antibiotic

- **Dim.Organism** - Table name
  - **Organism** – Name of variable in Dim.Organism table
  - Includes the actual names of the organisms which grew in culture

- **Dim.Antibiotic** – Table name
  - **Antibiotic** – Name of variable in Dim.Antibiotic table
  - Includes the actual names of the antibiotics tested against the organisms which grew in culture

- Use OrganismSID and AntibioticSID from these dimension tables to link to Micro.Antibioticsensitivity
A unique count of MicrobiologySID gives you the number of all microbiology cultures for the study cohort and time frame.

A unique count of MicrobiologySID gives you the number of bacteriology cultures for the study cohort and time frame.

A unique count of MicrobiologySID gives you the number of bacteriology cultures with antibiotic susceptibility testing for the study cohort and time frame.
Overview of Process for Identifying an Antibiotic Resistant Organism

- Identify the organism, e.g. *Klebsiella*
- Identify the antibiotic(s) of interest, e.g. ertapenem, imipenem
- Merge with Micro.AntibioticSensitivity fact table to obtain cohort and specimen specific information and the variable field ‘AntibioticSensitivityInterpretation’
- Standardize the antibiotic sensitivity results in ‘AntibioticSensitivityInterpretation’ as S=Susceptible, I=Intermediate Susceptibility or R=Resistant
- Describe your organisms by percentage resistant

*Disclaimer: This is one of several approaches.*
Step 1: Identify a full list of the ‘Organism’ variable

Screen shot of the results of a query from Dim.Organism by the ‘Organism’ variable
Step 2: Review and categorize organisms

- Review of the ‘Organism’ list to categorize into the causative organism of interest
  - *Klebsiella oxytoca*, *Acinetobacter baumanii*

- Recent review of Dim.Organism found 259 unique versions of *Klebsiella*

<table>
<thead>
<tr>
<th>Organism</th>
<th>Organism_category</th>
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<tbody>
<tr>
<td>ESBL K. OXYTOCA</td>
<td>KLEBSIELLA_OXYTOCA</td>
</tr>
<tr>
<td>KLEB OXYTOCA STR 1</td>
<td>KLEBSIELLA_OXYTOCA</td>
</tr>
<tr>
<td>KLEB OXYTOCA str 1</td>
<td>KLEBSIELLA_OXYTOCA</td>
</tr>
<tr>
<td>KLEB OXYTOCA STR 2</td>
<td>KLEBSIELLA_OXYTOCA</td>
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<tr>
<td>KLEBSIELLA OXYTOCA (ESBL POSITIVE)</td>
<td>KLEBSIELLA_OXYTOCA</td>
</tr>
<tr>
<td>KLEBSIELLA OXYTOCA (ESBL)</td>
<td>KLEBSIELLA_OXYTOCA</td>
</tr>
<tr>
<td>KLEBSIELLA OXYTOCA <em>CRE</em></td>
<td>KLEBSIELLA_OXYTOCA</td>
</tr>
<tr>
<td>KLEBSIELLA OXYTOCA <em>ESBL</em></td>
<td>KLEBSIELLA_OXYTOCA</td>
</tr>
<tr>
<td>KLEBSIELLA OXYTOCA <em>ESBL/CRE</em></td>
<td>KLEBSIELLA_OXYTOCA</td>
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<tr>
<td>KLEBSIELLA PNEUMONIA - CRE</td>
<td>KLEBSIELLA_PNEUMONIAE</td>
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<tr>
<td>KLEBSIELLA PNEUMONIA (ESBL)</td>
<td>KLEBSIELLA_PNEUMONIAE</td>
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<tr>
<td>KLEBSIELLA PNEUMONIA (KPC)</td>
<td>KLEBSIELLA_PNEUMONIAE</td>
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<td>KLEBSIELLA PNEUMONIA <em>ESBL</em></td>
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<tr>
<td>KLEBSIELLA PNEUMONIA ESBL POS</td>
<td>KLEBSIELLA_PNEUMONIAE</td>
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</tbody>
</table>
Step 3: Identifying a full list of antibiotics tested against organisms

Screen shot of results for Dim.Antibiotic, where the field of interest is ‘Antibiotic’
Step 4: Review and categorize antibiotics tested

- Review of the ‘Antibiotic’ list to categorize into antibiotics of interest
  - ie. Identify all carbapenems
- Variability by site, year, misspellings, etc.

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<thead>
<tr>
<th>Antibiotic</th>
<th>From Dim.Antibiotic</th>
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<tbody>
<tr>
<td>ERTAPENEM</td>
<td>Abx</td>
</tr>
<tr>
<td>ERTAPENEM ET</td>
<td>ERTA</td>
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<tr>
<td>ERTAPENEM KB</td>
<td>ERTA</td>
</tr>
<tr>
<td>ERTAPENEM MIC</td>
<td>ERTA</td>
</tr>
<tr>
<td>ERTAPENEM.</td>
<td>ERTA</td>
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<tr>
<td>IMIPENEM</td>
<td>IMIP</td>
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<td>IMIPENEM 4.0</td>
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<td>IMIPENEM AFB</td>
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<td>IMIPENEM.</td>
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<tr>
<td>IMIPENEM/CILASTATIN</td>
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<td>IMIP</td>
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<td>IMP</td>
<td>IMIP</td>
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<td>MERO</td>
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<td>DORIPENEM</td>
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<table>
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<th>Study categorization</th>
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<td>DORI</td>
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<td>MERO</td>
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Step 5: Linking of 3 tables

- Dim.Organism (limited to ORGANISMS OF INTEREST)
- Dim.Antibiotic (limited to ANTIBIOTICS OF INTEREST)
- Micro.AntibioticSensitivity (categorized as S, I, or R)
Step 6: Identify antibiotic susceptibilities and categorize

- ‘AntibioticSensitivityInterpretation’ is also a text-based field, so look at the full listing in order to categorize results that are
  - S=Susceptible
  - I=Intermediate Susceptibility
  - R=Resistant
Review of Process for Identifying an Antibiotic Resistant Organism

- Identify the organism and standardize, e.g. *Klebsiella*
- Identify the antibiotic(s) of interest and standardize, e.g. ertapenem, imipenem
- Merge with Micro.AntibioticSensitivity fact table to obtain cohort and specimen specific information and the variable field ‘AntibioticSensitivityInterpretation’
- Standardize the antibiotic sensitivity results in ‘AntibioticSensitivityInterpretation’ as S=Susceptible, I=Intermediate Susceptibility or R=Resistant
- Describe your organisms by percentage resistant

*Disclaimer: This is one of several approaches.*
Considerations for Example 1

• These fields are not standardized, so requires data cleaning to ensure accurate identification


• Consider all possible variations including alternate spellings, misspellings, phrasing, and abbreviations

• Quantitative information like MICs may be in the interpretation field and may need further categorization

• Use of the ‘AntibioticSensitivityValue’ field with the ‘AntibioticSensitivityInterpretation’ field in combination may be warranted
Example 2: Antibiotic treatment/exposure
Example 2: Joining Organisms and Treatment

Specimen taken
Grows *Staphylococcus aureus*

Vancomycin Rx

9/8/2017
• Live demonstration
Agenda for Presentation

• Overview of Microbiology and Pharmacy domains

• Two examples

• Limitations and strengths

• Other Resources
Limitations to Microbiology and Pharmacy Data Use

- Remember that workup and data entry may not be systematic
- Be aware of selective reporting
- Text-based fields: Not standardized
- If interested in negative cultures, must make assumptions that any specimen NOT in all other fact tables but they have Micro.Microbiology.
  - Be aware of organisms or resistance stored in other places (ie. Lab Chem)
  - Use all the fact tables to find organisms because eg. Yeast won’t just be in mycology.
Limitations to Microbiology and Pharmacy Data Use

- Outside the VA prescriptions and microbiology can’t be captured

- Pharmacy data: BCMA does not include outpatient, ER, or hemodialysis, surgery/OR
  - Can look at orders or IV to see if they got it; but it’s a search

- ER has stock of antibiotics that may not be logged, except in notes: natural language processing needed
Limitations to Microbiology and Pharmacy Data Use

- Dose: not standardized. Difficult to use.
- BCMA limited – route of administration can be different than what is in the patient record from pharmacy
- Prolonged administration or extended infusions can be documented at start or finish.
- Data quality has not been assessed for most
Microbiology and Pharmacy Domain Strengths

- Includes culture data on bacteria, viruses, fungi, parasites
- Millions of Microbiology and Pharmacy records from an integrated healthcare system
- Ability to link with other CDW data sources (ie. encounters)
- Opportunity to answer SOME clinical, epidemiologic, and health services and outcomes research questions on infectious disease that otherwise would not be possible with one or two sites
- Pharmacy: outpatient and inpatient BCMA is good
  - Since ~2005; quality of BCMA implementation has been monitored and is high.
Sample of currently VA funded studies using these data

• CARRIAGE QUERI (Rubin/Evans/Perencevich)
  • CRE (C. Evans)
  • SSTOP (M. Rubin/M. Goetz)
• Actionable Knowledge to Guide Antimicrobial Stewardship (M. Jones)
• Understanding and Improving Decision-making in Pneumonia with Informatics (B. Jones)
• Comparative Effectiveness of Strategies to Control S. Aureus Infections (M. Schweizer)
• PSCI on Measurement to Advance Patient Safety (Rosen, Gupta, et al)
Poll #4: Your plans

What are your future plans for using CDW microbiology and pharmacy data? (Select all that apply)

- I do not plan to use these data in the future
- Assess risk factors for infection or antibiotic resistance/treatment
- Evaluate outcomes (morbidity, mortality, or costs) for infection
- Conduct surveillance, infection control, or antimicrobial stewardship activities
- Evaluate impact of national initiatives on infections, antibiotic resistance, or stewardship
- Other (please specify)
Agenda for Presentation

• Overview of Microbiology and Pharmacy domains
• Two examples
• Limitations and strengths
• Other Resources
VHA Data Portal

Welcome to the VHA Data Portal

The VHA Data Portal promotes a knowledge-sharing culture that supports the needs of VHA data users. The Portal integrates information from multiple sources into a single location to promote a comprehensive knowledge base and to facilitate a positive end-user experience.

The one-stop-shop for data users’ needs.

Our home page design has recently changed to help you get the information you need. Each one of the badges below links to access information and other relevant resources for a particular data use need, or use the new top navigation menu to locate resources by category. Tell us what you think.

New Data User

Research

Operations & Quality Improvement

Access Policy & Administrative Tools

Quick Links Library

Data Management and Access Plan (DMAP)

Effective January 1, 2016, all applications for VA-ORIF funding are required to include a Data Management and Access Plan (DMAP) in the proposal. Applicants are encouraged to work with the local VA research offices in order to describe the DMAP in an application, and for implementation of the plan. The DMAP will be evaluated as an unscored element in the scientific peer review, and any issues will be addressed administratively.

VistaWeb Access for Medical Advisory Opinions

As of July 1, 2016, access to VistaWeb for Medical Advisory Opinions (MAO) reviews do not expire after 60 days. Access will also be granted nationally to all Vista systems.
Basic information and resources for researchers interested in CDW data, including:

CDW Summary Documentation
http://vaww.virec.research.va.gov/CDW/Documentation.htm

- **Summary Documentation** on the CDW datasets includes factbooks, domain layouts, data contents, sample records, and frequencies.
- Medical SAS Outpatient variables have been mapped to CDW data fields. Visit the "NPDC CDW Transition" page on CDW’s SharePoint site to access the map and for information on differences in variable formatting, data transformations and calculated variables only in the Medical SAS files.
- VINCI’s Intranet site, [VINCI Central](http://vaww.virec.research.va.gov/CDW/Documentation.htm), provides in-depth information on VINCI including data sources, support, training, and guides for using VINCI.
- The [CDW SharePoint site](http://vaww.virec.research.va.gov/CDW/Documentation.htm) has a announcements section that provides up-to-date information on topics such as newly released data, missing data and training available.
# VIReC Options for Specific Questions

## HSRData Listserv
- Community knowledge sharing
- ~1,200 VA data users
- Researchers, operations, data stewards, managers

## HelpDesk
- Individualized support
  - [virec@va.gov](mailto:virec@va.gov)
  - (708) 202-2413

9/8/2017
Contact information

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<td>Linda Kok, MA</td>
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