CDW: A Conceptual Overview 2017

by Margaret Gonsoulin, PhD

March 29, 2017

Thanks to:

- Richard Pham, BISL/CDW for his mentorship
- Heidi Scheuter and Hira Khan for organizing this session

VIReC
RESEARCHERS' GUIDE TO VA DATA

Poll #1: Your CDW experience

- How would you describe your level of experience with CDW data?
  - 1- Not worked with it at all
  - 2
  - 3
  - 4
  - 5- Very experienced with CDW data

Agenda for Today

- Get to the bottom of all of those acronyms!
- Learn to think in “relational data” terms
- Become familiar with the components of CDW
  - Production and Raw Domains
  - Fact and Dimension tables/views
- Understand how to create an analytic dataset
  - Primary and Foreign Keys
  - Joining tables/views

VIReC
RESEARCHERS' GUIDE TO VA DATA

Agenda for Today

- **<u>Get to the bottom of all of those acronyms!</u>**
- Learn to think in "relational data" terms
- Become familiar with the components of CDW
  - Production and Raw Domains
  - Fact and Dimension tables/views
- Creating an analytic dataset
  - Primary and Foreign Keys
  - Joining tables/views

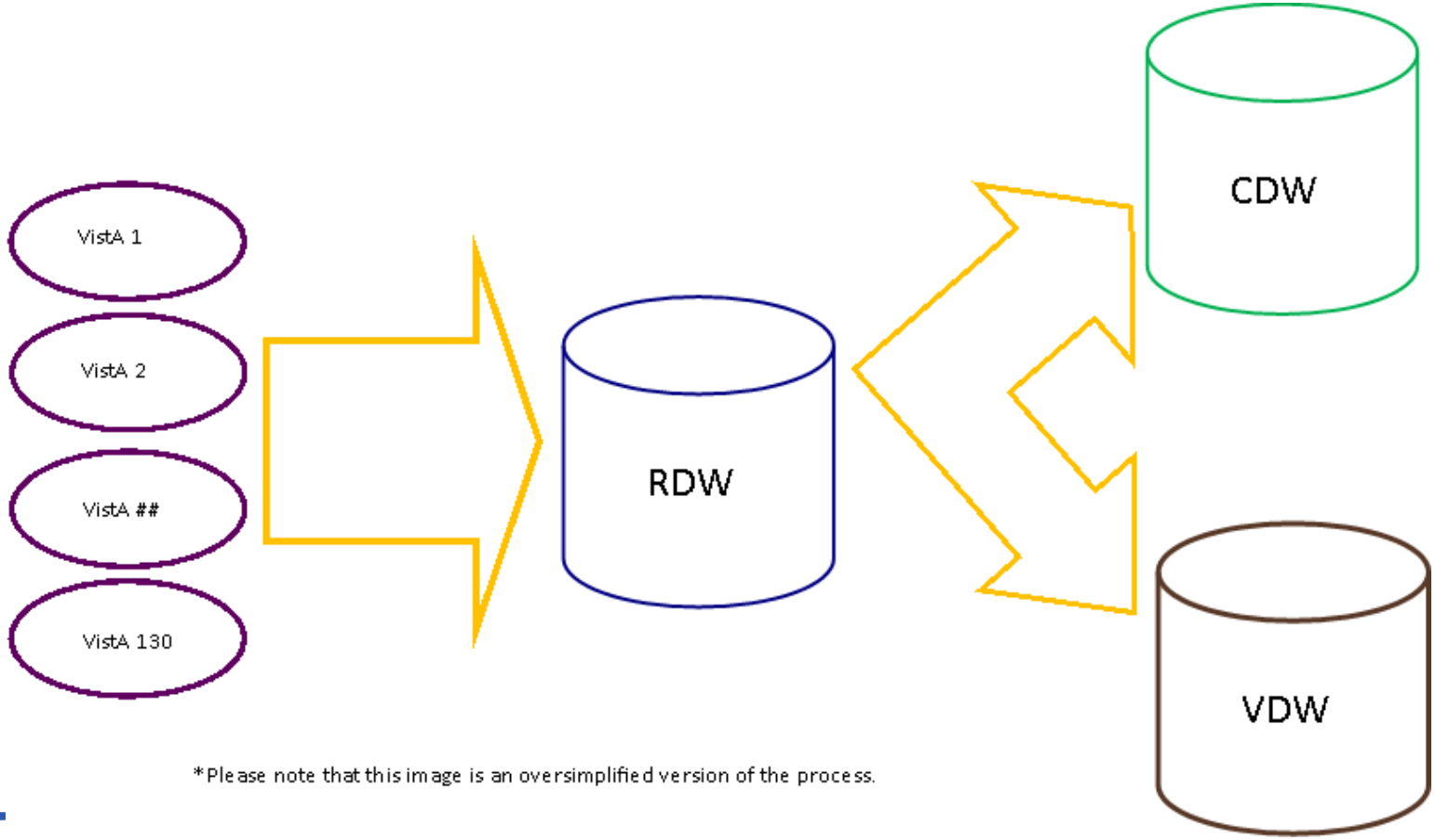
VIReC
RESEARCHERS' GUIDE TO VA DATA

“C”DW, “R”DW & “V”DW

- Users will see documentation referring to xDW.
- The “x” is a variable waiting to be filled in with either:
  - “V” for VISN,
  - “R” for region or
  - “C” for corporate (meaning “national VHA”)
- Each organizational level of the VA has its own data warehouse focusing on its own population.
- This talk focuses on CDW only.

VIReC
RESEARCHERS' GUIDE TO VA DATA

Flow of data into the warehouse



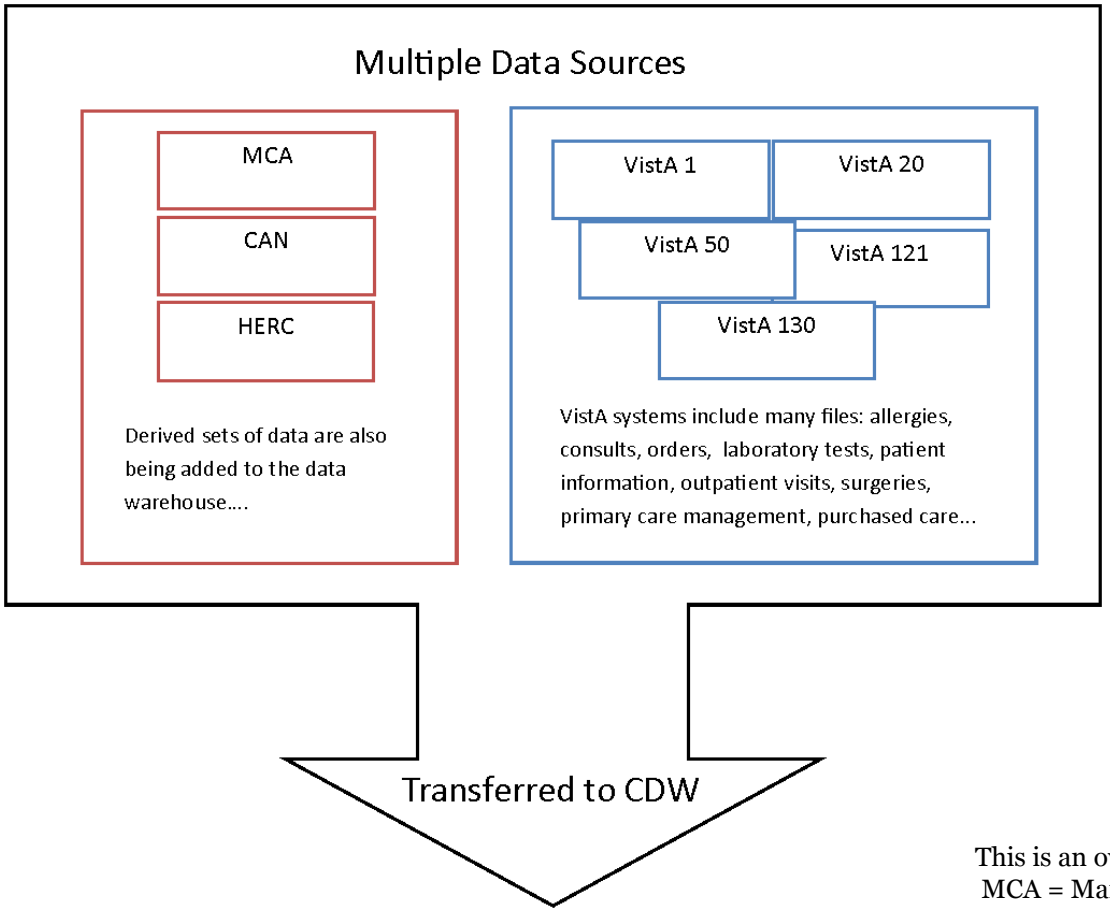
*Please note that this image is an oversimplified version of the process.

VistA = Veterans Health Information Systems and Technology Architecture

C“DW”

- The “DW” in CDW stands for “Data Warehouse.”
- Data Warehouse = a data delivery system intended to give users the information they need to support their business decisions.
- In ordinary terms, it is a large storage facility for “big data.”

What type of data get stored here?



notes
This is an oversimplified description.
MCA = Managerial Cost Accounting
CAN = Care Assessment Need
HERC = Health Economics Resource Center

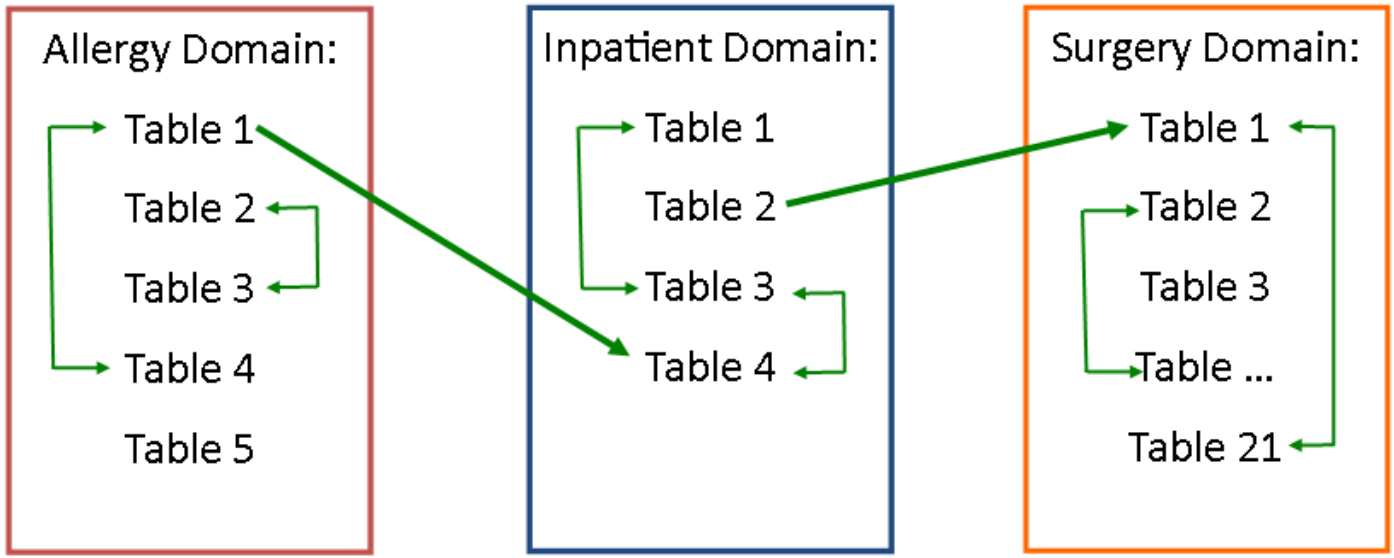
VIReC
RESEARCHERS' GUIDE TO VA DATA

How the CDW organized?

CDW organizes data into data domains

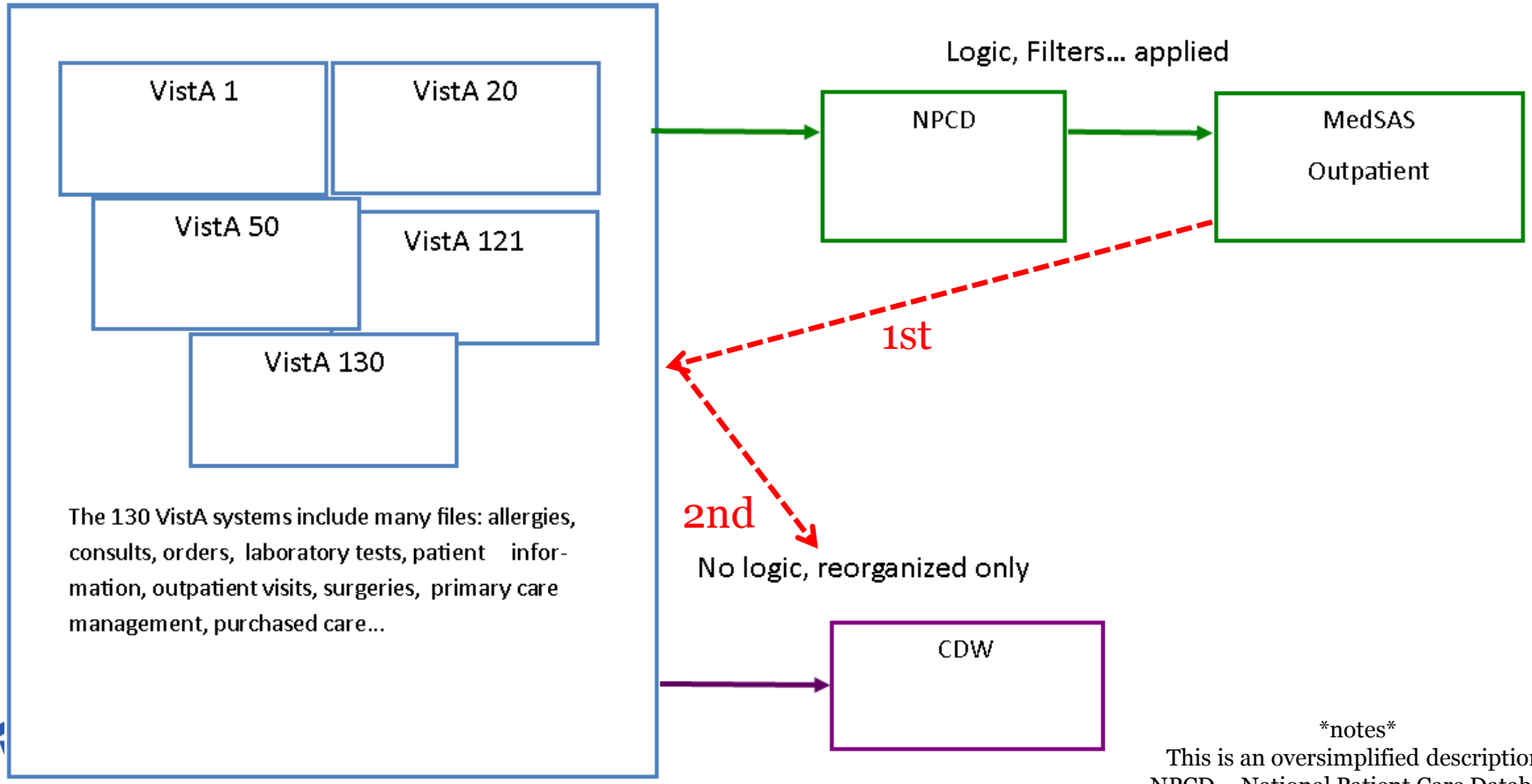
with multiple tables in each domain

and builds linking keys to connect tables and domains:



VIReC
RESEARCHERS' GUIDE TO VA DATA

How does CDW fit into VA Data?



notes
This is an oversimplified description.
NPCD = National Patient Care Database
MedSAS = Medical SAS

Agenda for Today

- Get to the bottom of all of those acronyms!
- **<u>Learn to think in "relational data" terms</u>**
- Become familiar with the components of CDW
  - Production and Raw Domains
  - Fact and Dimension tables/views
- Creating an analytic dataset
  - Primary and Foreign Keys
  - Joining tables/views

VIReC
RESEARCHERS' GUIDE TO VA DATA

C“D”W- The data.

- Data stored in this warehouse are in a “relational” format.
- In ordinary terms, these are data that have been separated out into multiple tables that look like spreadsheets.
- Linking keys are added into these tables so that users may reassemble the tables for analytic use.
- SQL programming language can be used to “reassemble” the tables.

VIReC
RESEARCHERS' GUIDE TO VA DATA

SQL = Structured Query Language

A common database, a "flat file"

LastName	FirstName	Address	CityState	Zipcode	ICD9	Sta3n	VisitDate
Jones	Marianna	123 Oak St	Bee, AR	70788	110.6	578	1/2/2014
Frank	Josie	11 Pine Ave	Flip, OK	30032	377.75	358	2/2/2014
Plank	Bill	230 5th St	Miner, TX	11201	202.05	402	3/3/2014

There are three main types of information in this "flat file"

1. Patient information (name and address)
2. Diagnosis the led to the visit (ICD9 code)
3. Information about the visit (station number and date)

VIReC
RESEARCHERS' GUIDE TO VA DATA

Transformed into a Relational Database

PatientTable

PatientKey	LastName	FirstName	Address	CityState	Zipcode
1	Jones	Marianna	123 Oak St	Bee, AR	70788
2	Frank	Josie	11 Pine Ave	Flip, OK	30032
3	Plank	Bill	230 5th St	Miner, TX	11201

DiagnosisTable

DxKey	ICD9
1	110.6
2	202.05
3	280.8
4	377.75

VisitTable

VisitKey	DxKey	PatientKey	Sta3n	Date
1	1	1	578	1/1/2014
2	4	2	358	2/2/2014
3	2	3	402	3/3/2014

VIReC
RESEARCHERS' GUIDE TO VA DATA

Poll #2: About you

- Which of the following best describes your role in the VA? (check all that apply)
  - Operations/Quality Improvement only
  - Research investigator/PI
  - Research data manager/analyst
  - Project coordinator
  - Both operations & research work
  - Other

Agenda for Today

- Get to the bottom of all of those acronyms!
- Learn to think in "relational data" terms
- **Become familiar with the components of CDW**
  - Production and Raw Domains
  - Fact and Dimension tables/views
- Creating an analytic dataset
  - Primary and Foreign Keys
  - Joining tables/views

VIReC
RESEARCHERS' GUIDE TO VA DATA

2 Parts of CDW (Production and Raw)

Corporate Data Warehouse (CDW)

Production Domains

The modeled/architected data domains are built to make using the information inside easier; they are updated nightly.

Raw Domains

The un-modeled data domains (close to VistA source) are updated on a variety of schedules

VIReC
RESEARCHERS' GUIDE TO VA DATA

Note - These domains are works-in-progress, and some raw domains will eventually become production domains.

Domains

Groups of tables based on the subject matter found within the group of tables

- Production Domains:
  - Outpatient 2.1
  - Lab Microbiology 2.0
  - Mental Health 1.2
  - Patient 2.0
  - Vital Sign 1.0
  - Patient Insurance 1.0
- Raw Domains
  - Intravenous Meds
  - Oncology
  - Prosthetics
  - Bill Claims
  - Radiology

Tables v. Views

- A table is a set of columns and rows that contain data elements.
- A view is the result of a procedure that pulls information out of a database into a virtual table; in simple terms it is a "virtual" table.

Sta3n	State	County	Country	PeriodOfService	MaritalStatus	InsuranceCoverageFlag	Religion
676	WISCONSIN	MILWAUKEE	UNITED STATES	PERSIAN GULF WAR	NEVER MARRIED	N	LUTHERAN
629	ARKANSAS	JEFFERSON	UNITED STATES	VIETNAM ERA	DIVORCED	U	BAPTIST
586	MISSISSIPPI	TIPPAH	UNITED STATES	PERSIAN GULF WAR	MARRIED	U	UNKNOWN/NO PREFERENCE
629	TEXAS	SMITH	UNITED STATES	POST-VIETNAM	SEPARATED	U	BAPTIST
636	NEBRASKA	LINCOLN	UNITED STATES	POST-KOREAN	*Missing*	U	*Missing*
623	OKLAHOMA	TULSA	UNITED STATES	PERSIAN GULF WAR	NEVER MARRIED	Y	UNKNOWN/NO PREFERENCE
676	PENNSYLVANIA	LANCASTER	UNITED STATES	POST-VIETNAM	NEVER MARRIED	NULL	ROMAN CATHOLIC CHURCH
623	OKLAHOMA	TULSA	UNITED STATES	VIETNAM ERA	MARRIED	Y	BAPTIST
676	WISCONSIN	MONROE	UNITED STATES	PERSIAN GULF WAR	MARRIED	Y	BAPTIST
636	CALIFORNIA	CALAVERAS	UNITED STATES	PERSIAN GULF WAR	MARRIED	U	CHRISTIAN (NON-SPECIFIC)
676	WISCONSIN	PORTAGE	UNITED STATES	OTHER NON-VETERANS	*Missing*	NULL	*Missing*
674	TEXAS	ANDERSON	UNITED STATES	WORLD WAR II	WIDOWED	Y	UNKNOWN/NO PREFERENCE
695	WISCONSIN	WAUKESHA	UNITED STATES	VIETNAM ERA	MARRIED	Y	*Missing*
674	TEXAS	HARRIS	UNITED STATES	VIETNAM ERA	DIVORCED	U	PROTESTANT, NO DENOMINATION

1. Dimension Tables

- These tables are used as supporting tables; each one holds a specific type of information that is meant to be accessed repeatedly
- These tables
  - do not contain patient information
  - can be viewed with basic read access
  - are relatively small in size

VIReC
RESEARCHERS' GUIDE TO VA DATA

2. Fact Tables

- These tables hold measurements
- They tend to be very large (up to trillions of records)
- They have patient and staff identifiers in them
- Therefore,
  - It is necessary to request permission to view these tables
  - It is important to plan your cohort to reduce the size of your request

VIReC
RESEARCHERS' GUIDE TO VA DATA

Fact tables and Dimension tables

PatientTable (Fact)

PatientKey	LastName	FirstName	Address	CityState	Zipcode
1	Jones	Marianna	123 Oak St	Bee, AR	70788
2	Frank	Josie	11 Pine Ave	Flip, OK	30032
3	Plank	Bill	230 5th St	Miner, TX	11201

DiagnosisTable (Dim)

DxKey	ICD9
1	110.6
2	202.05
3	280.8
4	377.75

VisitTable (Fact)

VisitKey	DxKey	PatientKey	Sta3n	Date
1	1	1	578	1/1/2014
2	4	2	358	2/2/2014
3	2	3	402	3/3/2014

VIReC
RESEARCHERS' GUIDE TO VA DATA

Prefixes or Schema / Type of table

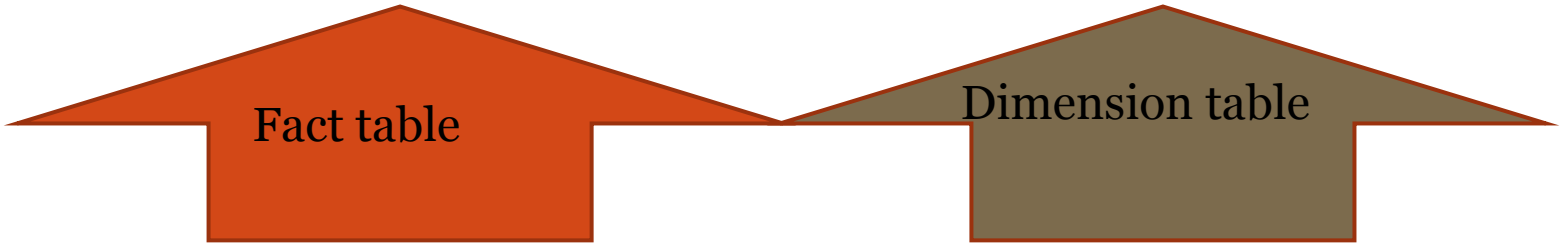
- Each table name is preceded by a prefix or schema used to indicate whether or not it is a:
  - A fact table (e.g., Schema.TableName)
  - A dimension table (always a "dim." schema)

Fact Tables	Dimension Tables
Dental.DentalAlerts CPRSOrder.OrderedItem Immun.Immunization Patient.Patient	Dim.OrderableItem Dim.AdmitSource Dim.Ethnicity Dim.Antibiotic

VIReC
RESEARCHERS' GUIDE TO VA DATA

Two types of tables/views

Health Factor 2.1 Domain	
HF.HealthFactor	Dim.HealthFactorType



HF and Dim tables in Health Factors

HF.HealthFactor Content

- Patient identifiers
- Staff identifiers
- Descriptions of the health factor type (such as “colonoscopy” and “flu vaccine done elsewhere”)
- Comments related to the health factor (such as "biopsy of polyp - benign" and "normal").

Dim.HealthFactorType Content

- Whether the health factor is a "factor" or a "category"
- Whether or not the health factor is gender specific
- Text describing the factors in words (e.g., "current smoker," "weight management," or "abuse/neglect")

Agenda for Today

- Get to the bottom of all of those acronyms!
- Learn to think in “relational data” terms
- Become familiar with the components of CDW
  - Production and Raw Domains
  - Fact and Dimension tables/views
- **<u>Creating an analytic dataset</u>**
  - Primary and Foreign Keys
  - Joining tables/views

VIReC
RESEARCHERS' GUIDE TO VA DATA

Joining Keys

- Primary Key –A column in every table that uniquely identifies each row.
- Foreign Key –These are column(s) in a table that correspond to or reference a primary key in another table.
  - Values of the foreign key may repeat
  - Names of foreign keys may differ from names of their matching primary keys

VIReC
RESEARCHERS' GUIDE TO VA DATA

Joining Keys

PatientTable (Fact)

PatientKey (PK)	LastName	FirstName	Address	CityState	Zipcode
1	Jones	Marianna	123 Oak St	Bee, AR	70788
2	Frank	Josie	11 Pine Ave	Flip, OK	30032
3	Plank	Bill	230 5th St	Miner, TX	11201

DiagnosisTable (Dim)

DxKey (PK)	ICD9
1	110.6
2	202.05
3	280.8
4	377.75

VisitTable (Fact)

VisitKey (PK)	DxKey (FK)	PatientKey (FK)	Sta3n	Date
1	1	1	578	1/1/2014
2	4	2	358	2/2/2014
3	2	3	402	3/3/2014

VIReC
RESEARCHERS' GUIDE TO VA DATA

2 methods of identifying joining keys

BISL CDW VISNs

BISL

CDW Home CDW Support Community MetaData

CDW Home

Site Contents

NEW TO CDW?

Are you getting started with the Corporate Data Warehouse (CDW)?

- Intro and Policies
- CDW Support
- CDW Metadata

WHAT'S IN THE WORKS?

- General Announcements
- Training Announcements
- CDW Domain Status and Priority (Excel)

EXTERNAL LINKS

- HSR&D Listserv
- VHA Data Portal
- DAR
- NDS
- System Status & Planned Outages

DATA ACCESS

Do you want to get connected to CDW? There are many types of access to CDW. The best thing to do before you start is to define what kind of access you need.

- Local Data Access (LSV)
- Data Access information
- CDW Customers and Workgroups

VIReC RESEARCHERS' GUIDE TO VA DATA

https://vaww.cdw.va.gov/Pages/CDWHome.aspx

Click “CDW metadata report”

BISL CDW VISNs

BROWSE PAGE

BISL

CDW Home CDW Support Community MetaData

MetaData Home
Libraries
CDW Metadata Wiki
Metadata Documents
Reports - SSRS
Data Sources
Reports
Schemas
VINCI Central
Social
VA Pulse
Site Contents

CDW Home > MetaData

CDW MetaData

Welcome to the CDW MetaData site, the site that contains information about the metadata for the CDW Data Domains in production. To begin, launch the **CDW Metadata Report**. Information pertaining to the *Meta* and *BaseCamp* views in a CDW database may be found in the CDW Metadata Wiki.

Metadata Documents

Current View ... Find a file

Name	Modified	Modified By
Active Directory 1.0	July 22, 2016	Dean, Mark A.
Allergy 1.0	February 19, 2014	Anderson, Stephen M. (BISL)
Appointment 2.0	February 19, 2014	Anderson, Stephen M. (BISL)
Consult 2.1	October 1, 2014	Dean, Mark A.

VIReC RESEARCHERS' GUIDE TO VA DATA

Actions | 1 of 1 | Find

CDW Metadata

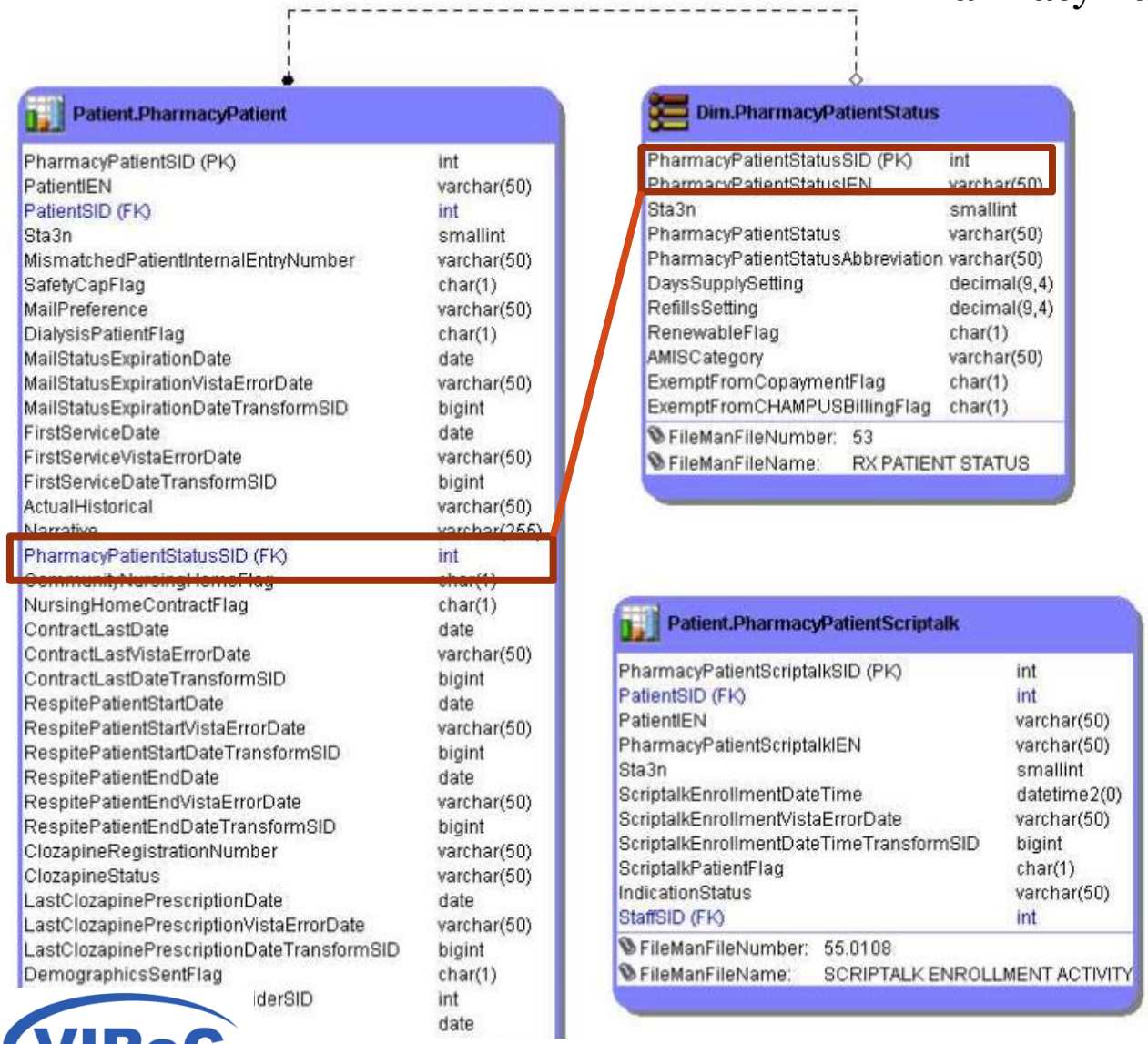
Contains a grouped list of available CDW ER Diagrams and members.

ImageDescription	
Active Directory 1.0	Image Date: 20 Jul 2016
Allergy 1.0	Image Date: 01 Feb 2014
Appointment 2.2	Image Date: 25 Apr 2016
Consult 2.1	Image Date: 24 Sep 2015
CPRSOrder 1.0	Image Date: 11 Aug 2014
Data Profiling 1.0	Image Date: 21 Feb 2014
Dental 1.0 Diagram 1 of 2	Image Date: 28 Oct 2015
Dental 1.0 Diagram 2 of 2 for Analytics	Image Date: 20 Apr 2016
Dimensions A Through D 7/8/2015	Image Date: 08 Jul 2015
Dimensions E Through K 7/8/2015	Image Date: 08 Jul 2015
Dimensions L Through O 5/4/2016	Image Date: 04 May 2016
Dimensions P Through R 3/7/2016	Image Date: 07 Mar 2016
Dimensions S Through Z 3/7/2016	Image Date: 07 Mar 2016
Dimensions, MRSA	Image Date: 31 Dec 2015
Dimensions, Place	Image Date: 30 Mar 2016
EDIS 1.0	Image Date: 13 Jan 2017

The metadata page lists each domain alphabetically

Click the name of the domain to open the “ER Diagram”

Pharmacy Patient Domain



Entity Relationship (ER) Diagrams are drawings of the relationships between the tables in the domain.

(PK) indicates a Primary Key

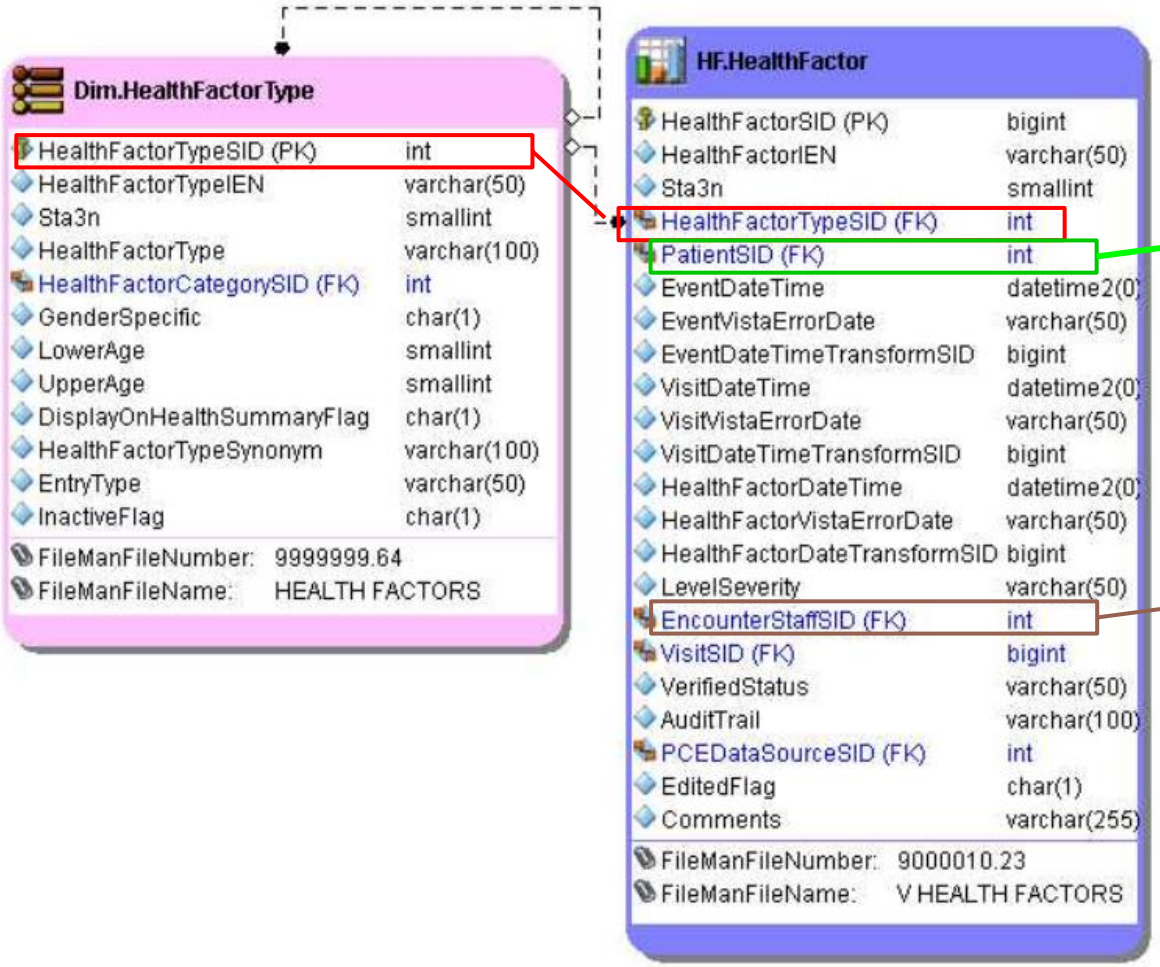
(FK) indicates a Foreign Key

These two join on *PharmacyPatientStatusSID*

VIReC
RESEARCHERS' GUIDE TO VA DATA

The Patient Domain (connections within a domain)

The Health Factors Domain (connections inside & outside of domain)



Note: the names of foreign keys may differ from names of their matching primary keys (such as EncounterStaffSID matching to StaffSID in the staff table.

Actions | 1 of 1 | Find

CDW Metadata

Contains a grouped list of available CDW ER Diagrams and members.

ImageDescription	
⊞ Active Directory 1.0	Image Date: 20 Jul 2016
⊞ Allergy 1.0	Image Date: 01 Feb 2014
⊞ Appointment 2.2	Image Date: 25 Apr 2016
⊞ Consult 2.1	Image Date: 24 Sep 2015
⊞ CPRSOrder 1.0	Image Date: 11 Aug 2014
⊞ Data Profiling 1.0	Image Date: 21 Feb 2014
⊞ Dental 1.0 Diagram 1 of 2	Image Date: 28 Oct 2015
⊞ Dental 1.0 Diagram 2 of 2 for Analytics	Image Date: 20 Apr 2016
⊞ Dimensions A Through D 7/8/2015	Image Date: 08 Jul 2015
⊞ Dimensions E Through K 7/8/2015	Image Date: 08 Jul 2015
⊞ Dimensions L Through O 5/4/2016	Image Date: 04 May 2016
⊞ Dimensions P Through R 3/7/2016	Image Date: 07 Mar 2016
⊞ Dimensions S Through Z 3/7/2016	Image Date: 07 Mar 2016
⊞ Dimensions, MRSA	Image Date: 31 Dec 2015
⊞ Dimensions, Place	Image Date: 30 Mar 2016
⊞ EDIS 1.0	Image Date: 13 Jan 2017

A second way of looking at linking keys:

expand the domain information to see table level metadata reports

Getting a list of joining keys

⊞ Dimensions S Through Z 4/17/2015	Image Date: 17 Apr 2015					
⊞ Dimensions, Place	Image Date: 09 Oct 2015					
⊞ Encounter 1.0	Image Date: 29 Oct 2013					
⊞ Health Factor 2.0	Image Date: 11 Mar 2015					
⊟ Health Factor 2.1	DWViewName	Field Count	FileMan File Data Source	View Version	Relevant Dates	Relationshi
	Dim.HealthFactorType	12	HEALTH FACTORS (9999999.64)	DWViewDeployed: xDWWork View Version: 3		
	HF.HealthFactor	21	V HEALTH FACTORS (9000010.23)	DWViewDeployed: SPVNext View Version: 34	Partition Key: HealthFactorDateTime	
⊞ ICD-9-CM and ICD-10-CM	Image Date: 24 Sep 2015					
⊞ ICD-9-PCS and ICD-10-PCS	Image Date: 10 Aug 2015					
⊞ Immunization 2.1	Image Date: 03 Jun 2015					

VIReC
RESEARCHERS' GUIDE TO VA DATA

Reading the "CDW foreign keys" table…

CDW Foreign Keys

Provides a listing of the foreign and primary keys for CDW views.

FKSchemaName	FKViewName	FKViewFieldName	FKViewVersion	PKSchemaName	PKViewName	PKViewFieldName
HF	HealthFactor	EncounterStaffSID	9	Staff	Staff	StaffSID
HF	HealthFactor	EncounterStaffSID	34	Staff	Staff	StaffSID
HF	HealthFactor	HealthFactorDateSID	34	Dim	Date	DateSID
HF	HealthFactor	HealthFactorTypeSID	9	Dim	HealthFactorType	HealthFactorTypeSID
HF	HealthFactor	HealthFactorTypeSID	34	Dim	HealthFactorType	HealthFactorTypeSID
HF	HealthFactor	PatientSID	9	Patient	Patient	PatientSID
HF	HealthFactor	PatientSID	34	Patient	Patient	PatientSID
HF	HealthFactor	PCEDataSourceSID	9	Dim	PCEDataSource	PCEDataSourceSID
HF	HealthFactor	PCEDataSourceSID	34	Dim	PCEDataSource	PCEDataSourceSID
HF	HealthFactor	VisitSID	9	Outpat	Visit	VisitSID
HF	HealthFactor	VisitSID	34	Outpat	Visit	VisitSID

Report Date: 11/18/2015 10:08:17 AM

The foreign key EncounterStaffSID in HF.HealthFactor connects to the primary key StaffSID in Staff.Staff.

VIReC RESEARCHERS' GUIDE TO VA DATA

Connecting the HF to a patient

CDW Foreign Keys

Provides a listing of the foreign and primary keys for CDW views.

FKSchemaName	FKViewName	FKViewFieldName	FKViewVersion	PKSchemaName	PKViewName	PKViewFieldName	Fk
HF	HealthFactor	EncounterStaffSID	9	Staff	Staff	StaffSID	Vi
HF	HealthFactor	EncounterStaffSID	34	Staff	Staff	StaffSID	Vi
HF	HealthFactor	HealthFactorDateSID	34	Dim	Date	DateSID	Vi
HF	HealthFactor	HealthFactorTypeSID	9	Dim	HealthFactorType	HealthFactorTypeSID	Vi
HF	HealthFactor	HealthFactorTypeSID	34	Dim	HealthFactorType	HealthFactorTypeSID	Vi
HF	HealthFactor	PatientSID	9	Patient	Patient	PatientSID	Vi
HF	HealthFactor	PatientSID	34	Patient	Patient	PatientSID	Vi
HF	HealthFactor	PCEDataSourceSID	9	Dim	PCEDataSource	PCEDataSourceSID	Vi
HF	HealthFactor	PCEDataSourceSID	34	Dim	PCEDataSource	PCEDataSourceSID	Vi
HF	HealthFactor	VisitSID	9	Outpat	Visit	VisitSID	Vi
HF	HealthFactor	VisitSID	34	Outpat	Visit	VisitSID	Vi

Report Date: 11/18/2015 10:08:17 AM

The foreign key PatientSID in HF.HealthFactor connects to the primary key PatientSID in Patient.Patient

VIReC
RESEARCHERS' GUIDE TO VA DATA

Summary/Conclusion

- CDW contains a variety of data.
- Currently, most of it comes from VistA.
- It is broken into many domains, fact tables and dimension tables that must be brought back together to create an analytic set.
- SQL and linking keys are necessary tools for creating that analytic set of data.

VIReC
RESEARCHERS' GUIDE TO VA DATA

Questions?

Margaret Gonsoulin, PhD

VIReC@va.gov

708-202-2413