




Experience Mining the World's Most Comprehensive Health Record Dataset

Scott L. DuVall



Sep 12 2013

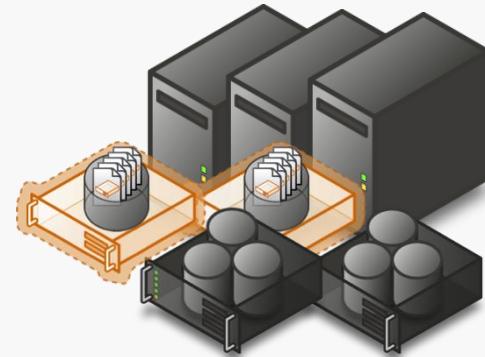
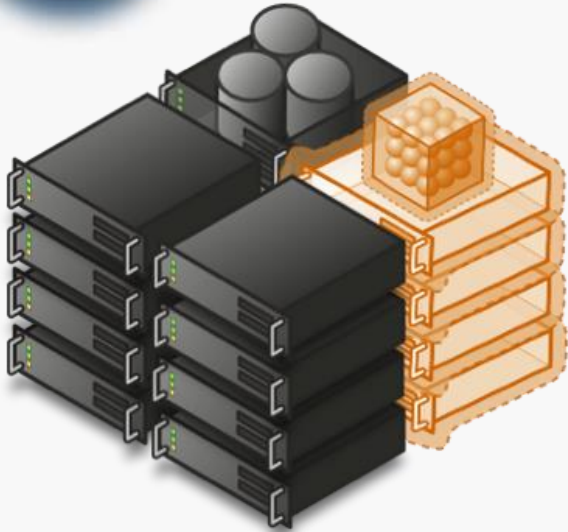




VINCI

- Establish a National Research Infrastructure
- Develop New Data Privacy & Security Capabilities
- Develop Remote Analysis Capability
- Prepare for Future Data Capabilities
- Partner With Other VA and Non-VA Entities





App Library | Pipeline Details | Batch Processing | v2011.12.3

Configuration | Save Pipeline | Load Pipeline | Load Saved Results | Exit

Services

- Fetch
- Tokenization
- Sentence Splitter
- POS Tagger
- Phrase Parser
- Tokenizer
- Reg Expression
- Tagger
- Matcher
- Other
- Review Results
- New Pipeline
- Clear Pipeline
- Run Pipeline

Pipeline 1 | Template Pipeline | Pipeline Options

Fetch

From: Director

Directory: []

Matcher

Search Group: Adjectives & Nouns, Adverbs, Conjunctions & Prepositions, Verbs, Quantifiers, Interjections, Particles, Punctuation, Other

Review Results

Results will be displayed for review.

Research Desktop First Look



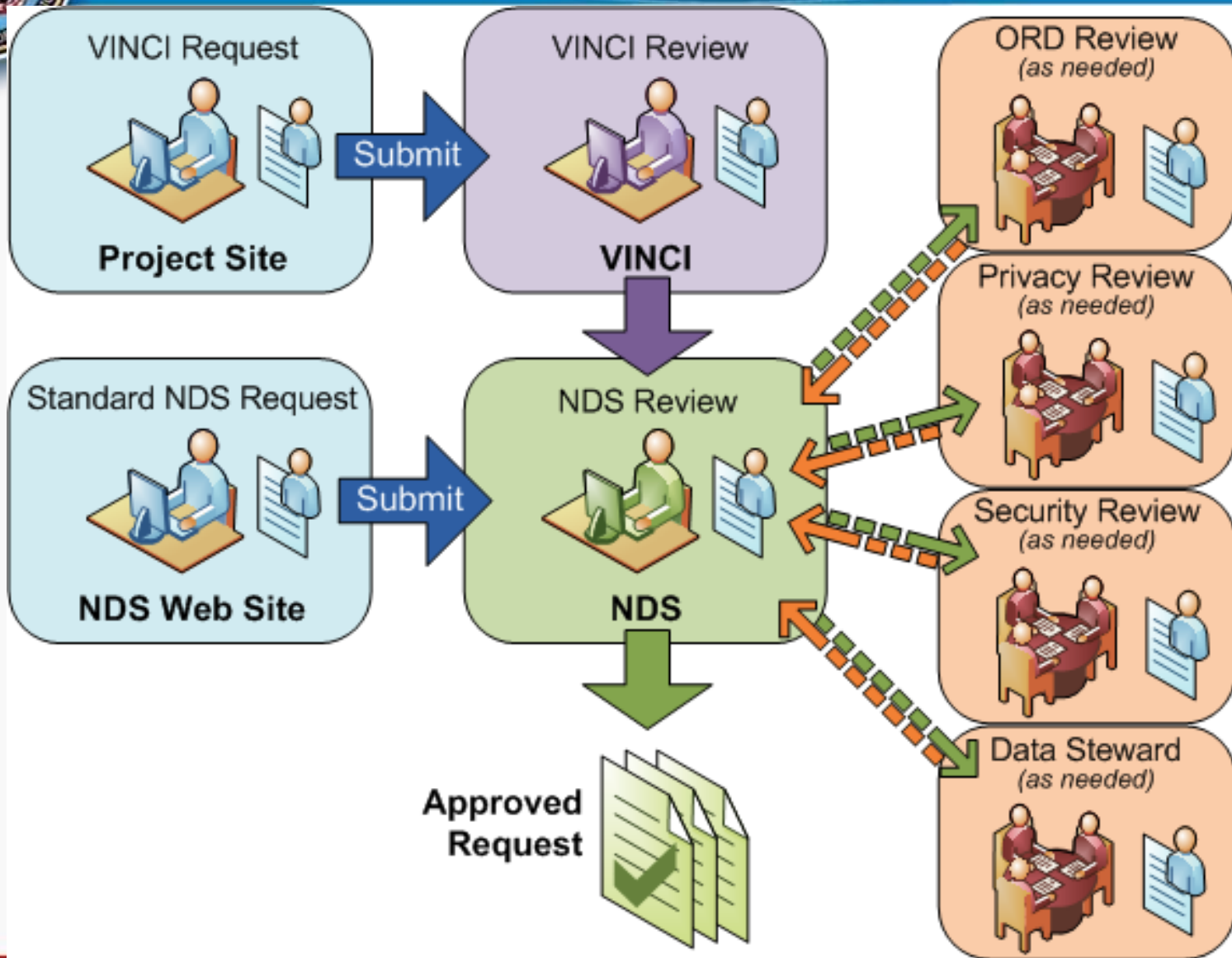
CREATE allows researchers to build their own mappings, criteria, and patient populations. Select which level you'd like to CREATE and get started!

Multiple Sclerosis

# of Patients in Population	VNCI	
	#	%
4	678,212	
24		
18		

Age at Index Date







Department of Veterans Affairs



Patient Selection

Patient List

Patients (All Patients)

OK

Cancel

- No Default
- Providers
- Team/Personal
- Specialties
- Clinics
- Wards
- All

- Ademopatient,Seven
- Ademopatient,Eight
- Ademopatient,Five
- Ademopatient,Four
- Ademopatient,Nine
- Ademopatient,One
- Ademopatient,Seven
- Ademopatient,Six
- Ademopatient,Ten
- Ademopatient,Three
- Ademopatient,Two
- Agraphingpatient,One
- Agraphingpatient,Two
- Bcma,Eight
- Bcma,Eighteen-Patient

Save Patient List Settings

Notifications

Info	Patient	Location	Urgency	Alert Date/Time	Message
	GRAPHINGP (G0901)		Moderate	08/08/2011@10:47	Abnormal labs - [SGOT]
	GRAPHINGP (G0901)		Moderate	04/23/2010@07:57	Surgical Pathology results available.
	GRAPHINGP (G0901)		Moderate	04/23/2010@07:57	Surgical Pathology results available.



Process Info

Process All

Process

Forward

Show Comments

Remove

Cover Sheet

Problems

Meds

Orders

Notes

Consults

Surgery

D/C Summ

Labs

Reports

ADEMPATIENT_SEVEN (OUTPATIENT) **Visit Not Selected** Primary Care Team Unassigned **Flag** VistaWeb No Postings
 666-00-0927 Oct 21, 1964 (47) Provider: PROVIDER,EIGHT Remote Data

Active Problems	Allergies / Adverse Reactions	Postings
Depression Allergic Rhinitis Hypertension Osteoarthritis	No Known Allergies	No Patient Postings Found.

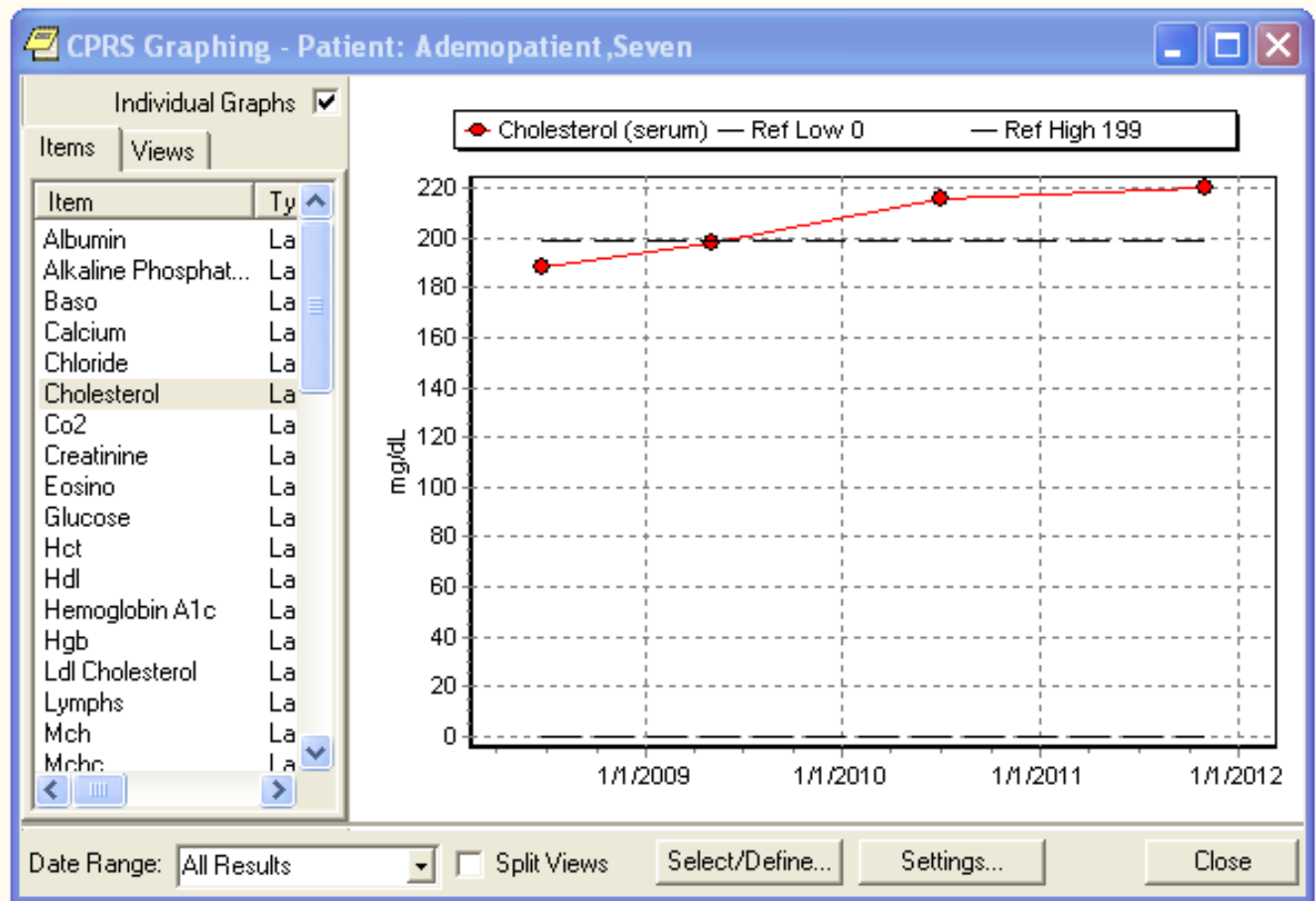
Active Medications	Clinical Reminders	Due Date
Citalopram Hydrobromide 20mg Tab Active	Hepatitis C risk Factor Screening	DUE NOW
Lisinopril 20mg Tab Active	Primary Care Depression Screening	DUE NOW
Hydrochlorothiazide 12.5mg Tab Active	Hypertension	DUE NOW
Acetaminophen 500mg Tab Active	SUICIDE HOTLINE	DUE NOW
Aspirin 81mg Ec Tab Active		
Chondroitin/Glucosamine Cap/Tab Active		
Fluticasone Furo 27.5mcg 120d Nasal Inhl Active		
Cetirizine Active		

Recent Lab Results	Vitals	Appointments/Visits/Admissions
Cholesterol Blood Serum W/c Lb #17900 Oct 31,11	T 99.2 F Jul 01,2010 14:00 (37.3 C) P 75 Jul 01,2010 14:00 R 15 Jul 01,2010 14:00 BP 127/82 Jul 01,2010 14:00 HT 68 in May 14,2010 14:00 (172.7 cm) WT 175 lb Jul 01,2010 14:00 (79.4 kg) POX 93 Jul 01,2010 14:00	Feb 21,12 08:00 Cardiology Action Required Dec 25,11 08:00 Primary Care Action Required

Lab Results Graph [From: Aug 25, 2011 to Feb 24, 2012]

- Most Recent
- Cumulative
- All Tests by Date
- Selected Tests
- Worksheet
- Graph**
- Microbiology
- Anatomic Pathc
- Blood Bank
- Lab Status

Graphing activated



ADEMOPATIENT_SEVEN (OUTPATIENT) Visit Not Selected Primary Care Team Unassigned
 666-00-0927 Oct 21,1964 (47) Provider: PROVIDER,EIGHT

Flag VistaWeb Remote Data ? No Postings

Sort by Status/Exp. Date (IMD first on Inpt)

Action	Outpatient Medications	Expires	Status	Last Filled	Refill...
	CITALOPRAM HYDROBROMIDE 20MG TAB Qty: 90 for 90 days Sig: TAKE ONE TABLET BY MOUTH EVERY DAY	05/01/12	Active	May 07,11	2
	LISINOPRIL 20MG TAB Qty: 90 for 90 days Sig: TAKE ONE TABLET BY MOUTH EVERY DAY	05/01/12	Active	May 07,11	2
	HYDROCHLOROTHIAZIDE 12.5MG TAB Qty: 90 for 90 days Sig: TAKE ONE TABLET BY MOUTH EVERY DAY	05/01/12	Active	May 07,11	2
	ACETAMINOPHEN 500MG TAB Qty: 240 for 30 days Sig: TAKE TWO TABLETS BY MOUTH EVERY 6 HOURS AS NEEDED	05/01/12	Active	May 07,11	10
	ASPIRIN 81MG EC TAB Qty: 30 for 30 days Sig: TAKE ONE TABLET BY MOUTH EVERY DAY	05/01/12	Active	May 07,11	10
	CHONDROITIN/GLUCOSAMINE CAP/TAB Qty: 90 for 30 days Sig: 2 TABLETS MOUTH EVERY 8 HOURS	05/01/12	Active	May 07,11	10
	FLUTICASON FUR 27.5MCG 120D NASAL INHL Qty: 50 for 90 days Sig: SPRAY 2 SPRAYS IN MOUTH EVERY DAY	05/01/12	Active	Apr 15,08	3
	CETIRIZINE Qty: 90 for 90 days Sig: TAKE ONE TABLET BY MOUTH EVERY DAY	05/01/12	Active	May 07,11	2

Action	Non-VA Medications	Start Date	Status

Action	Inpatient Medications	Stop Date	Status	Location

ADEMOPATIENT, SEVEN (OUTPATIENT)	Visit Not Selected	Primary Care Team Unassigned	Flag	VistaWeb	No Postings
666-00-0927	Oct 21, 1964 (47)	Provider: PROVIDER,EIGHT		Remote Data	

Last 100 Signed Notes (Total: 8) Visit: 07/01/10 PRIMARY CARE GENERAL NOTE, GENERAL MEDICINE, ONE PROVIDER (Jul 01,10@13:00)

- ☐ All signed notes
- ☐ Jul 01,10 PRIMARY
- ☐ May 21,10 PRIMAR
- ☐ May 14,10 PRIMAR
- ☐ May 11,09 PRIMAR
- ☐ May 04,09 PRIMAR
- ☐ Jun 25,08 PRIMAR
- ☐ Apr 22,08 PRIMAR
- ☐ Apr 15,08 PRIMAR

LOCAL TITLE: PRIMARY CARE GENERAL NOTE
 STANDARD TITLE: PRIMARY CARE NOTE
 DATE OF NOTE: JUL 01, 2010@13:00 ENTRY DATE: MAR 01, 2011@09:22:19
 AUTHOR: PROVIDER,ONE EXP COSIGNER:
 URGENCY: STATUS: COMPLETED

CC
 F/U Depression

The patient indicates that his symptoms have improved significantly, but not as much as he expected. He is still sleeping a lot (about 12 hours per day) and finds it hard to concentrate on looking for work. He denies suicidal ideation. His PHQ-9 score is 16 today.

The patient has a history of binge eating episodes. He is an emotional eater and often feels out of control, but continues to eat after job search disappointments. He often binges at night and has done this 3-4 times per week for the past several years.

Professional Diagnosis:
 Axis I:
 Major Depression, partial response to meds
 Binge eating disorder

Axis II:
 Deferred

Axis III:
 Hyperlipidemia, obesity

< [] >

Templates

New Note



Investigate the
Target Study
Population

Discover the
Care Workflow

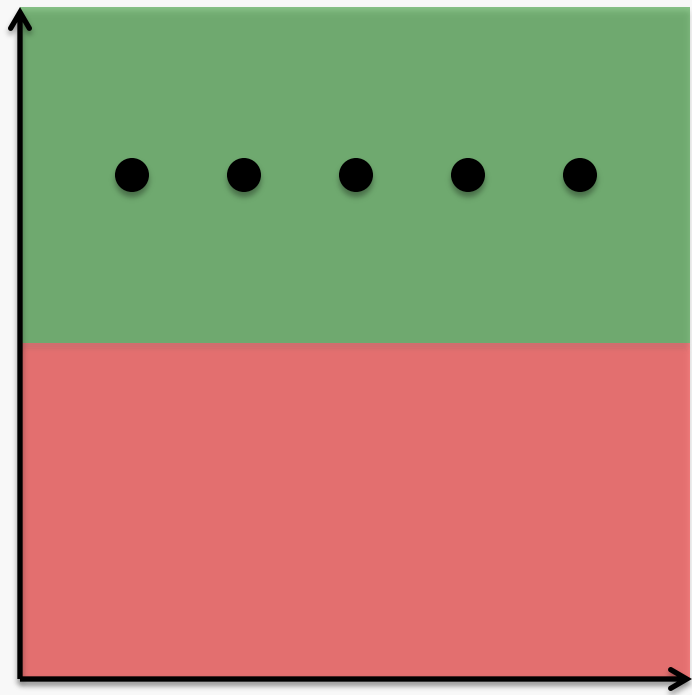
Understand the
Underlying Data





Positive
Evidence

Negative
Evidence



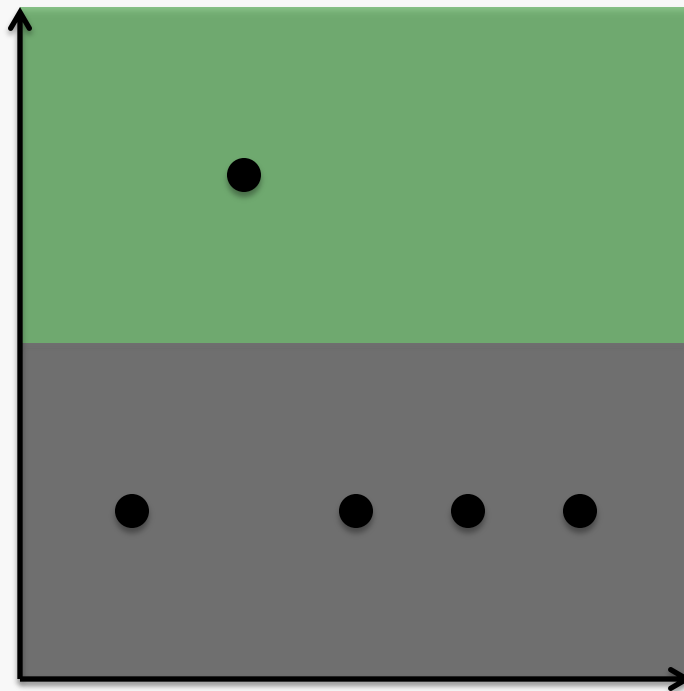
Time





Positive
Evidence

No
Evidence



Time

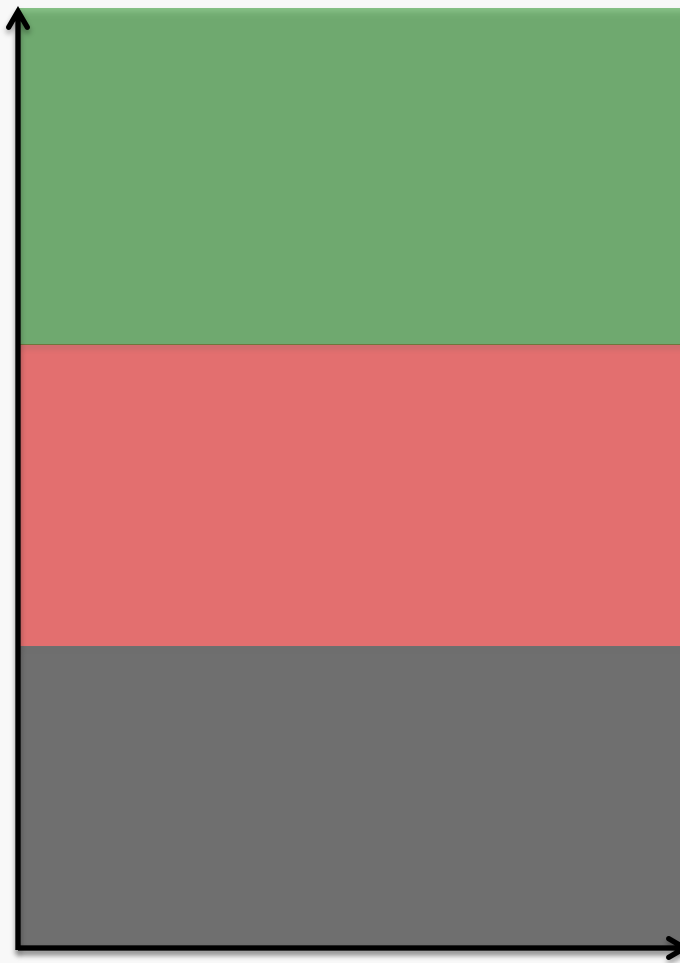




Positive
Evidence

Negative
Evidence

No
Evidence



Time

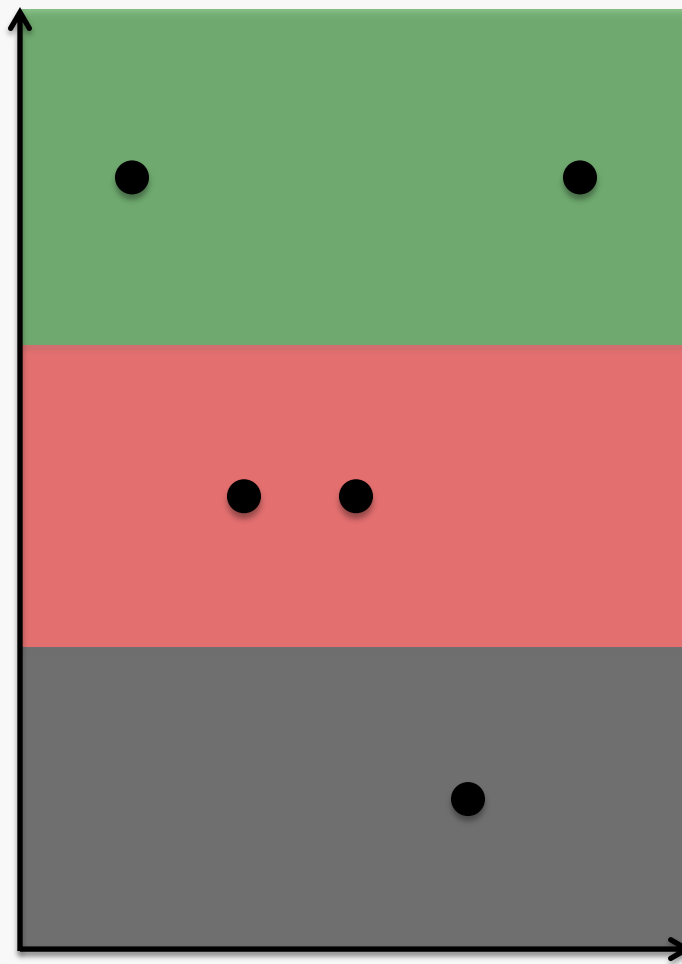




Positive
Evidence

Negative
Evidence

No
Evidence



Time

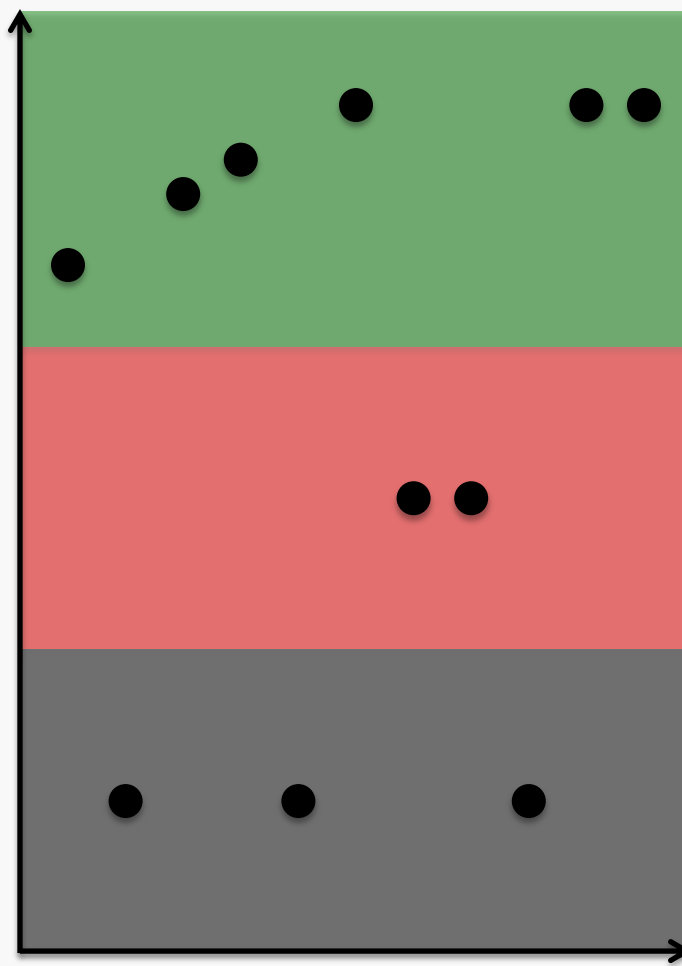




Positive
Evidence

Negative
Evidence

No
Evidence



Time

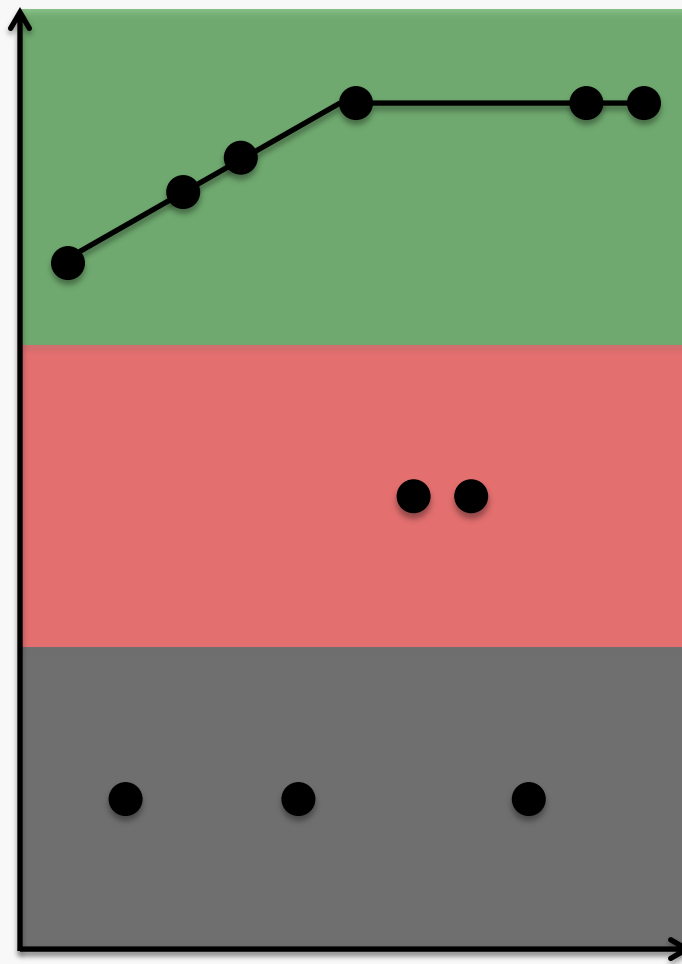




Positive Evidence

Negative Evidence

No Evidence



Time





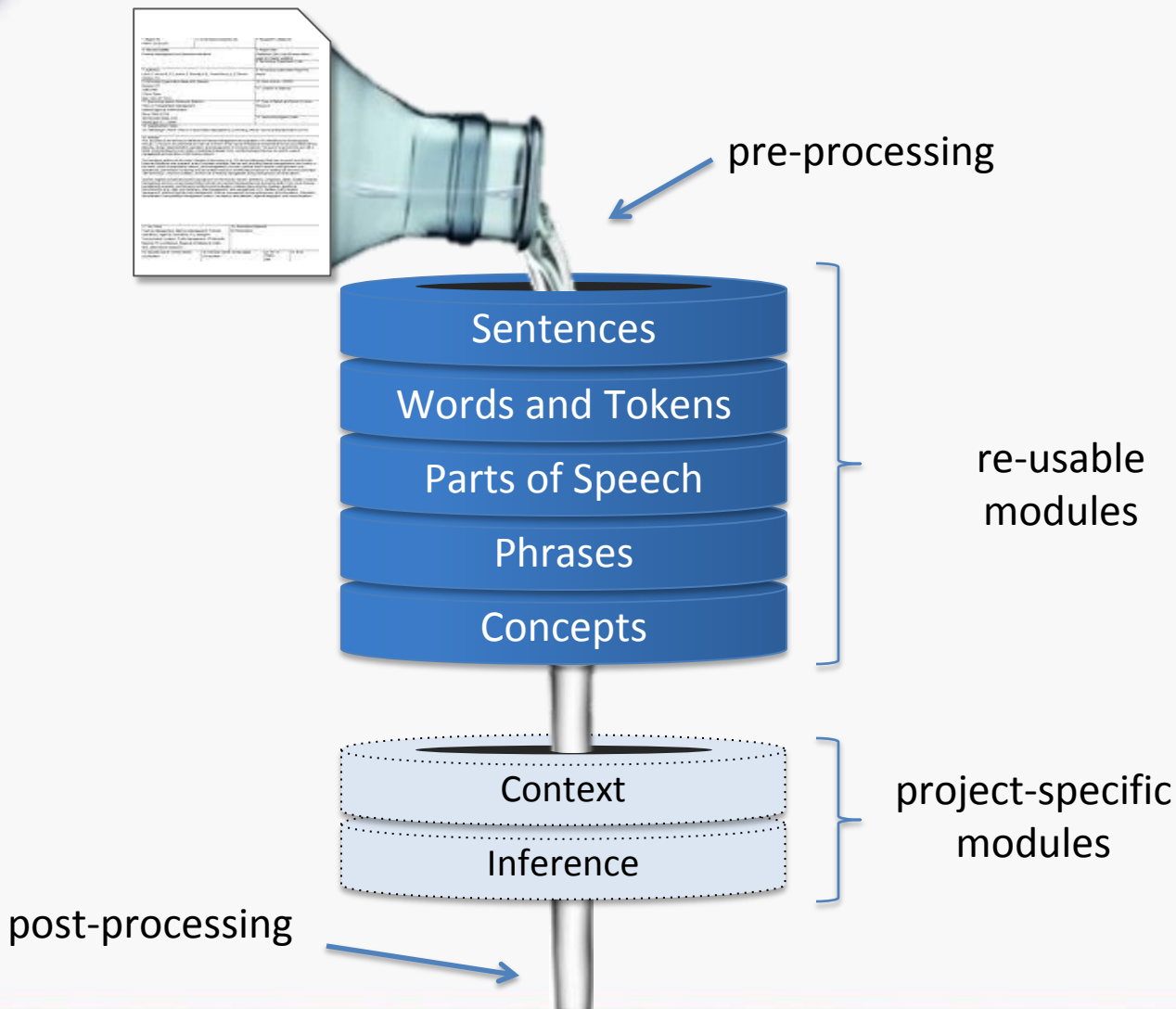
NLP Research

- New methods and tools
- Challenges:
 - Find information
 - Decode information





NLP Pipeline





What Can NLP Do?

Who

What

When

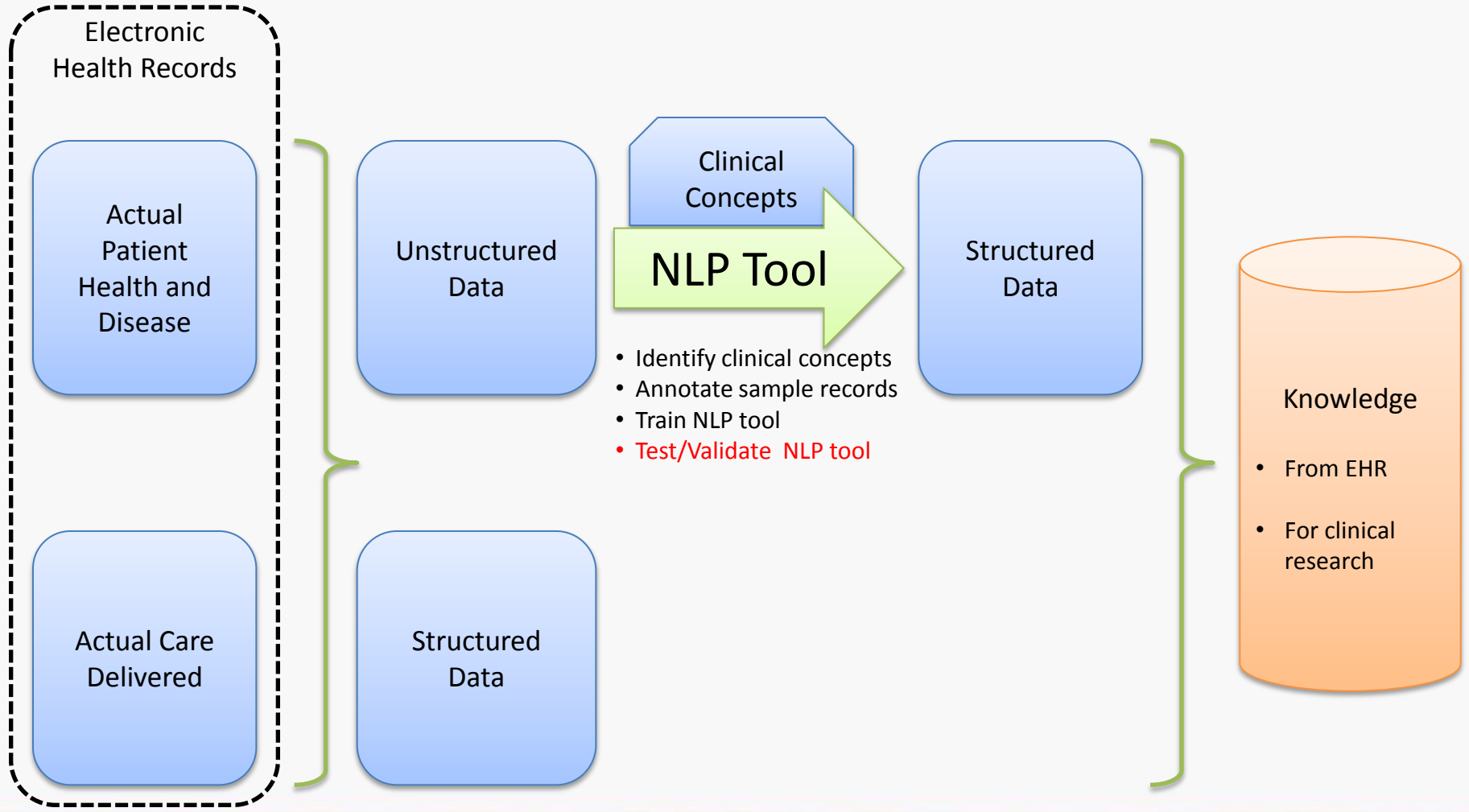
Where



Why

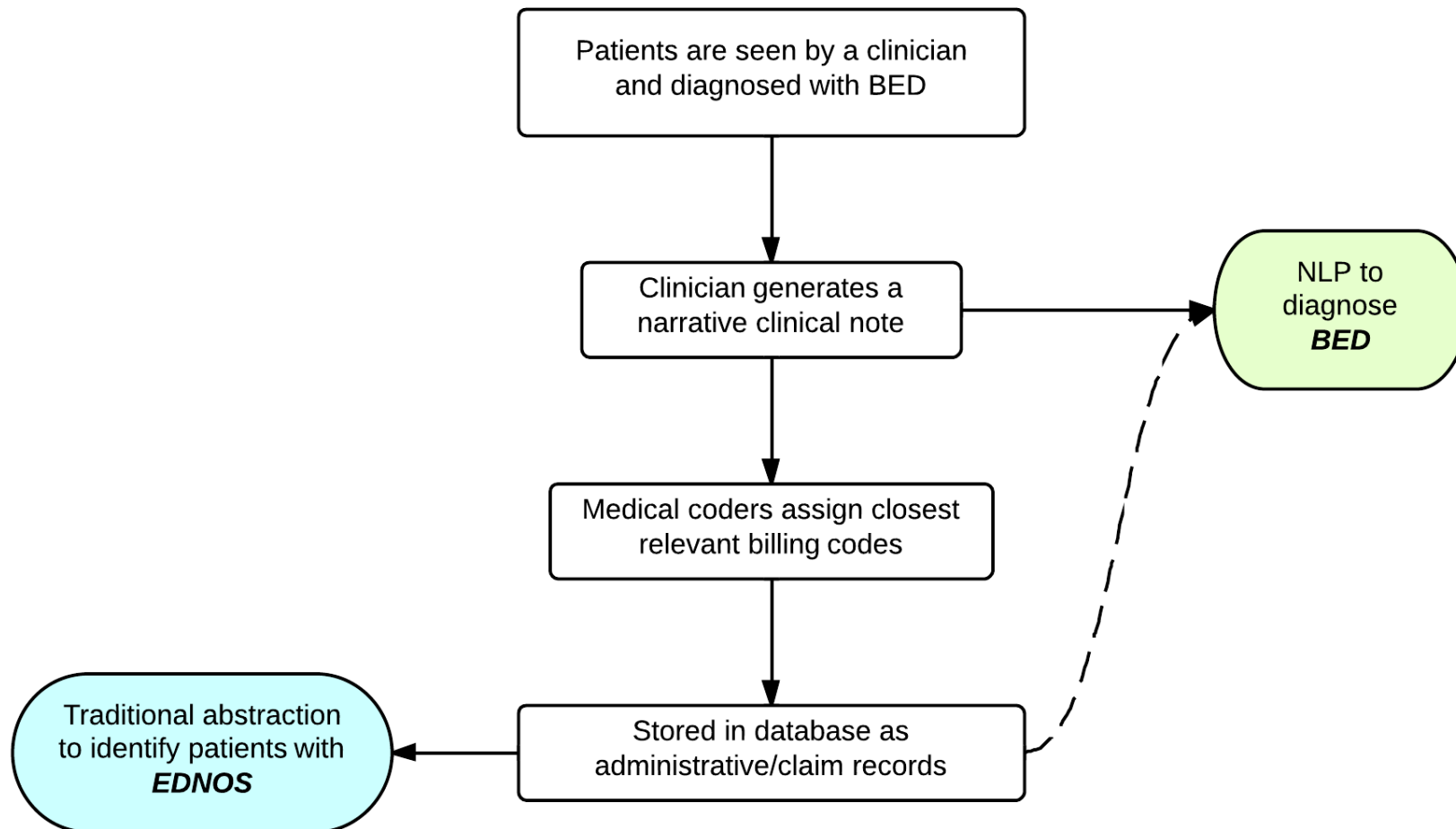
How







Binge Eating Disorder





The initial set of terms and phrases used to describe a diagnosis of BED for NLP development:

- Addictive eating
- Binge eating disorder
- Binge eat
- Binge eater
- Binge eating
- Eating disorder
- EDNOS
- Eating episode
- Not elsewhere classified (NEC)
- NOS
- Over eat
- Over-eat
- Overeating
- Over-eating
- Over eater
- Over-eater





Result Editor

SYSTEM Setting

Sync Assignments

EXIT

NAVIGATOR

- 4 Classes: [5/5 annotations]
 - BED Diagnosis [1/1]
 - BED Emotional Behaviors [2/2]
 - BED Frequency [1/1]
 - BED Physical Behaviors [1/1]
- Public Attributes: [0/0]
- Relationships: [0/0]

Document Viewer

binge.txt

Text Display | Annotation Information | Reports

CC F/U Depression

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Professional Diagnosis:
 Axis I:
 Major Depression, partial response to meds
Binge eating disorder
 Axis II:
 Deferred
 Axis III:
 Hyperlipidemia, obesity

EDITOR

Annotation Editor

Selected Annotations:

Binge eating disorder

Span: 619 | 640 : Binge ea

Class: BED Diagnosis

Comment:

Relationships:

Attributes:

Creation Date: Tue Jul 02 04:19:09 CDT 2013

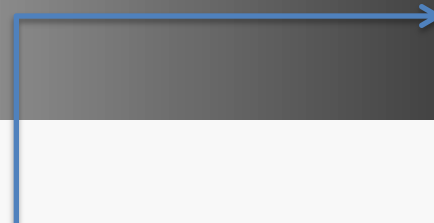
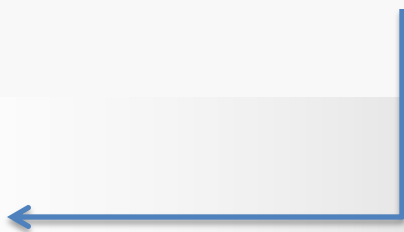
Annotator: BED Annotator 1

Current Note | All Notes

Find



keyword searches



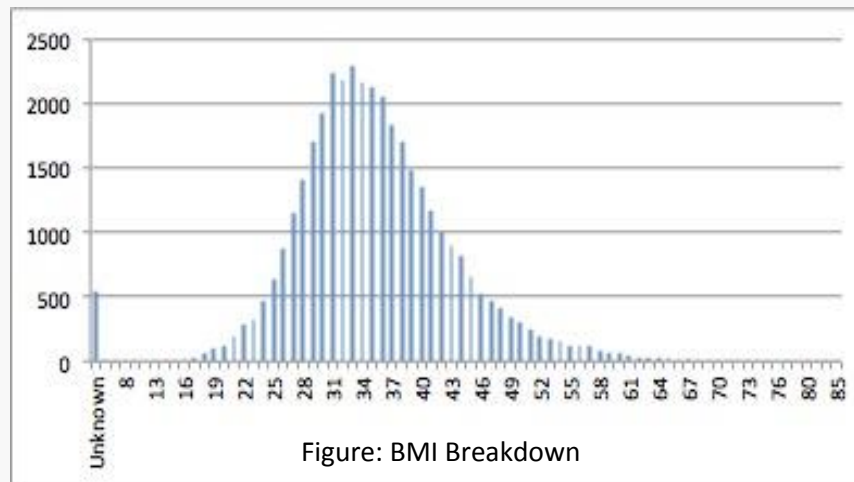
contextual understanding





Simple Keyword Searches

- Preliminary queries found **37,191** distinct patients in VINCI with at least one mention of "binge eating" in a clinical note
 - **31,504 (84.7%)** had a diagnosis code for obesity (ICD-9 code 278.0)
 - **27,751 (74.6%)** had a record of a BMI > 30 kg/m²





Does not meet criteria

- Patient reports history of bulimia nervosa. Currently purges 1x per month after binge eating.
- Patient does not meet criteria for binge eating disorder at this time due to purging behaviors.
- Patient engages in binge-eating behaviors. However, the frequency of these episodes, as well as the qualitative aspects of the binging, are insufficient to meet criteria for binge eating disorder.





Consistent, but not complete

- Reported binge eating daily - eating one large meal per day, experiencing it as anesthetic.
- Describes some symptoms of depression and binge eating.
- Binge eating due to stress with 15 pound weight gain in recent months.





Differential, denies

- possible binge eating disorder
- R/O binge eating disorder
- The patient's responses to the Questionnaire on Eating and Weight Patterns-Revised (QEWP-R) indicate the possibility of binge eating disorder
- patient reported no history of anorexia, binge eating disorder, or bulimia
- patient denies binge eating





Information and templates

Topics discussed in group: Emotional eating.

Handouts:


Binge Eating Disorder,

Emotional Eating: The Facts,

Food Cravings: The Science Behind Them,

Weight-Loss Myths That Will Not Die.





Binge Eating Disorder Symptoms

- ___ A. Recurrent episodes of binge eating characterized by
 1. eating within any two hour period an amount of food that is definitely larger than most people would eat in a similar time.
 2. a sense of lack of control over eating during the episode.

- ___ B. The binge-eating episodes are associated with three or more of the following:
 1. eating much more rapidly than usual.
 2. eating until feeling uncomfortably full.
 3. eating large amounts of food when not feeling physically hungry.
 4. eating alone because embarrassed by how much one is eating.
 5. feeling disgusted with oneself, depressed, or very guilty after overeating.

- ___ C. Marked distress regarding binge eating is present.

- ___ D. The binge eating occurs, on average, at least two days a week for 6 months.

- ___ E. The binge eating is not associated with the regular use of inappropriate compensatory behaviors (purging, fasting, excessive exercise)



Describes some symptoms of depression and binge eating.

1.7 billion notes

filter notes
→
that contain binge and eat

Describes some symptoms of depression and **binge eating**.

Patient has history of **binge eating** disorder.

193,450 notes

Describes some symptoms of depression and binge eating.

Patient has history of **binge eating disorder**.

Identify variations of "binge eating disorder"





Describes some symptoms of depression and binge eating.

Patient has history of **binge eating disorder**.

emotional eating. Passed out pamphlets on anorexia, **binge eating disorder**, and

Patient concerned about bingeing.
r/o binge eating d/o.

No variation of "binge eating disorder" found

Use surrounding words as context cues

Patient has history of **binge eating disorder**.

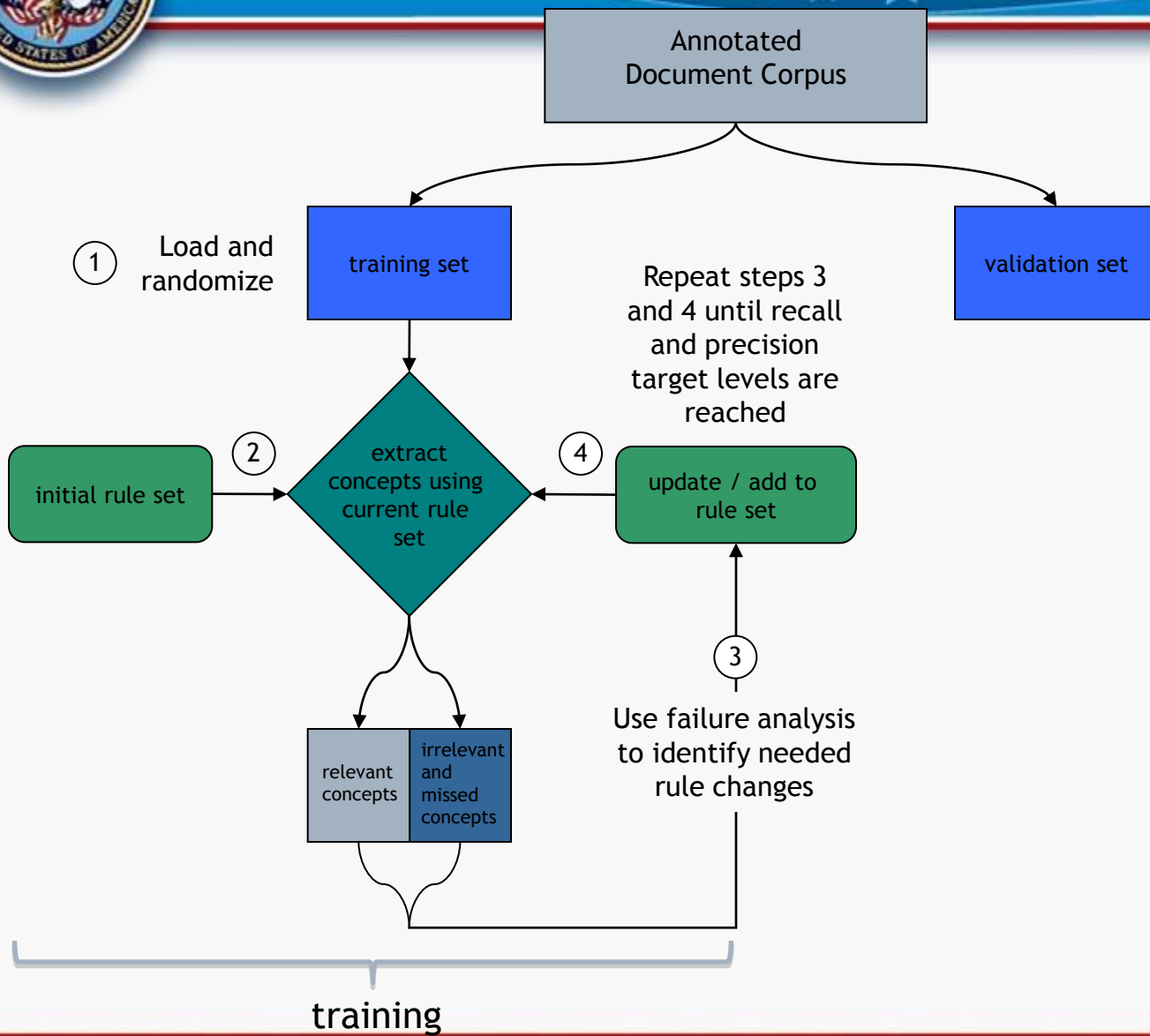
emotional eating. Passed out pamphlets on anorexia, **binge eating disorder**, and

Patient concerned about bingeing.
r/o binge eating d/o.

DIAGNOSIS

irrelevant

POSSIBLE





CHEX

Home

Reports

Admin ▾

▾ Change Validation

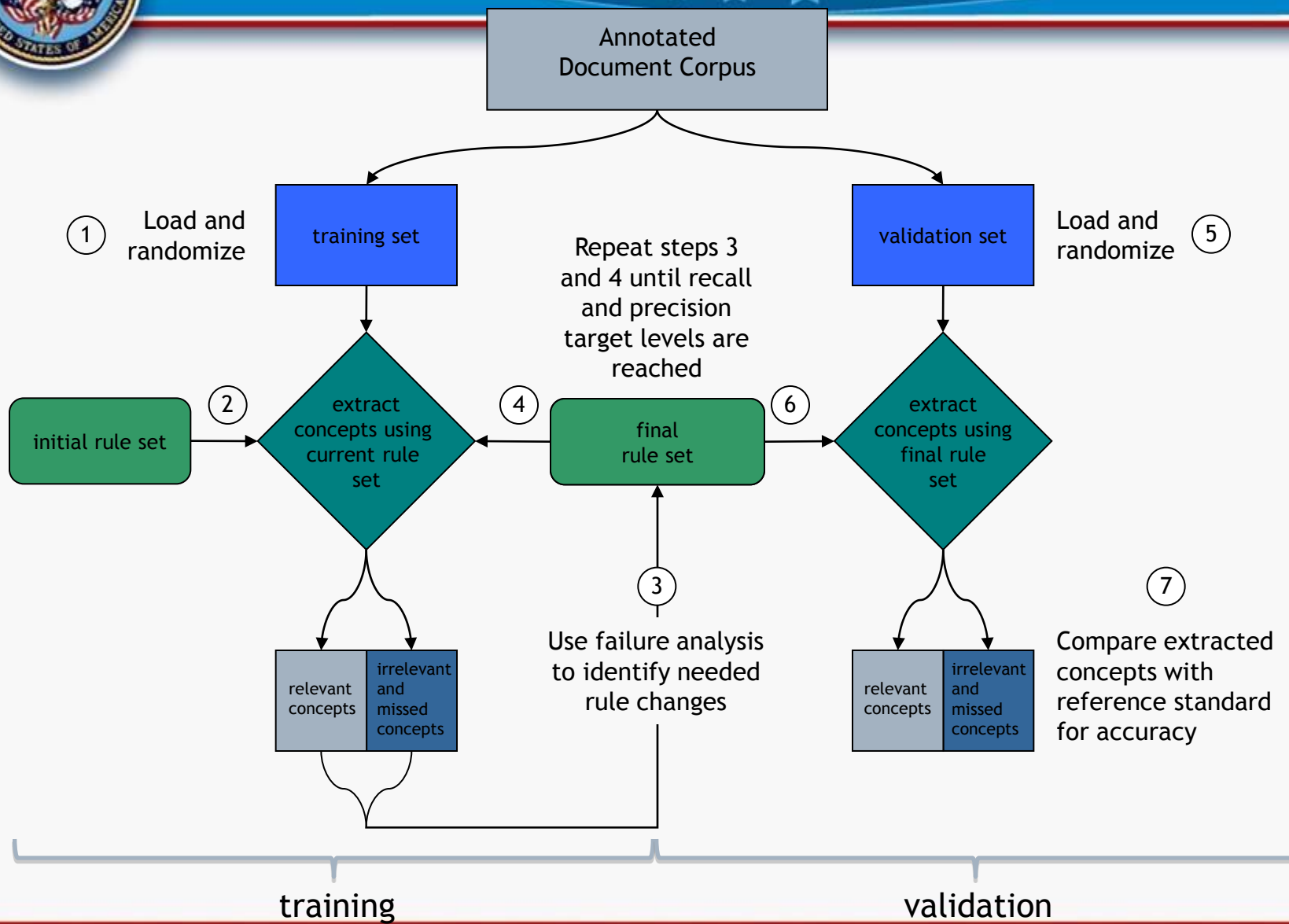
Settings

Logout

Instances to Validate

Snippet	Metadata		Validation
Professional Diagnosis: Axis I: Major Depression, partial response to meds Binge eating disorder Axis II:	Relevant: TRUE Assertion: PRESENT	<input type="button" value="🔍"/> <input type="button" value="i"/>	All Correct ▾ <input type="button" value="Add Comment"/>
Patient does not meet criteria for binge eating disorder at this time due to purging behaviors.	Relevant: TRUE Assertion: PRESENT	<input type="button" value="🔍"/> <input type="button" value="i"/>	Assertion Incorrect ▾ <input type="button" value="Add Comment"/>







Instances Reviewed	Correctly Identified BED Diagnosis		BED Diagnosis				Possible BED***	
			Yes		No			
N	N	%*	N	%**	N	%**	N	%**
1000	918	91.8%	731	90.7%	177	96.6%	92	91.3%
1000	917	91.7%	730	90.9%	175	95.4%	95	90.5%
1000	824	82.4%	759	80.9%	165	84.8%	76	92.1%

*Weighted average of the system classification across all classifications

**Percent that human reviewer agreed with the system classification

***Includes differential diagnoses

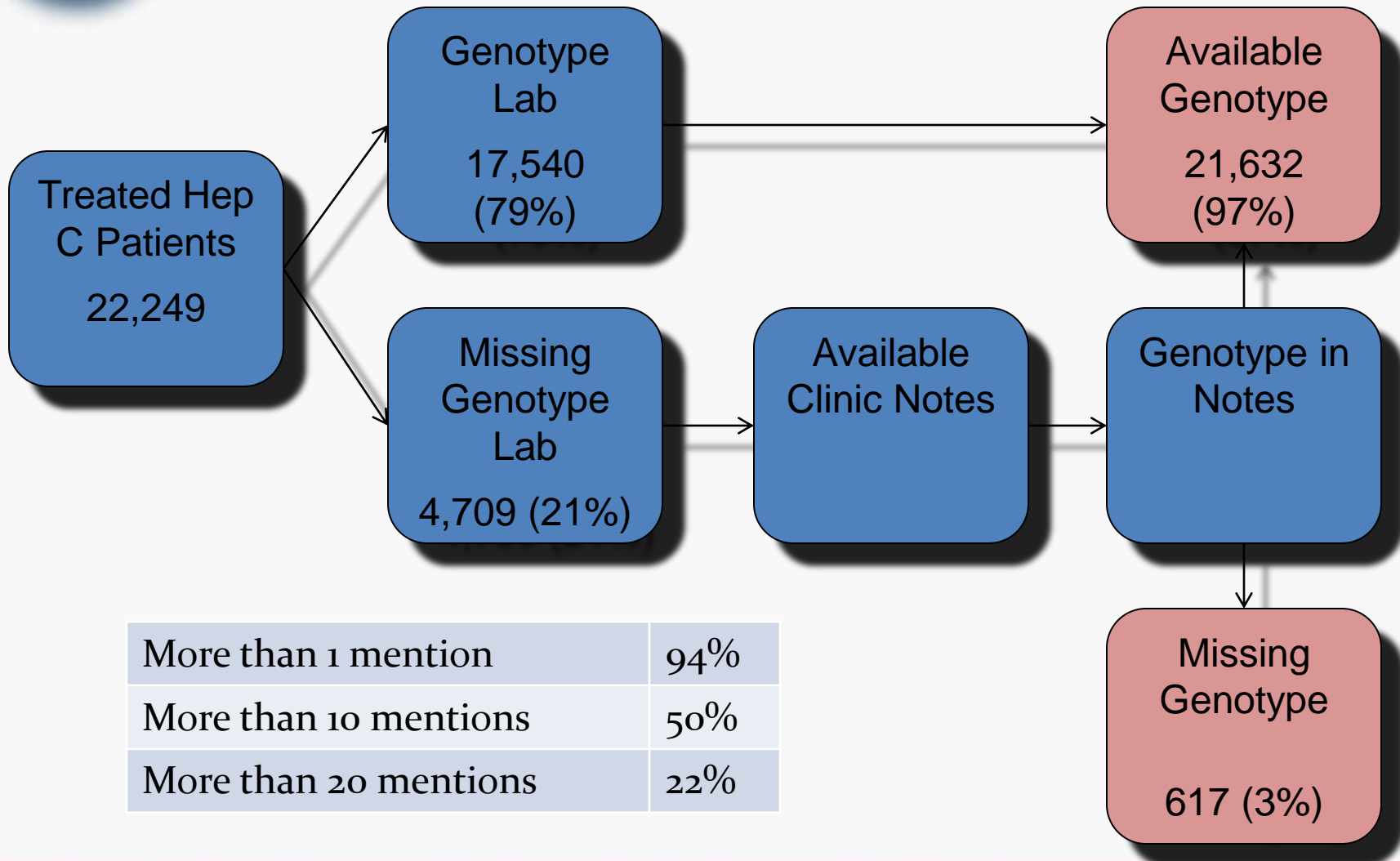




NLP in clinical research

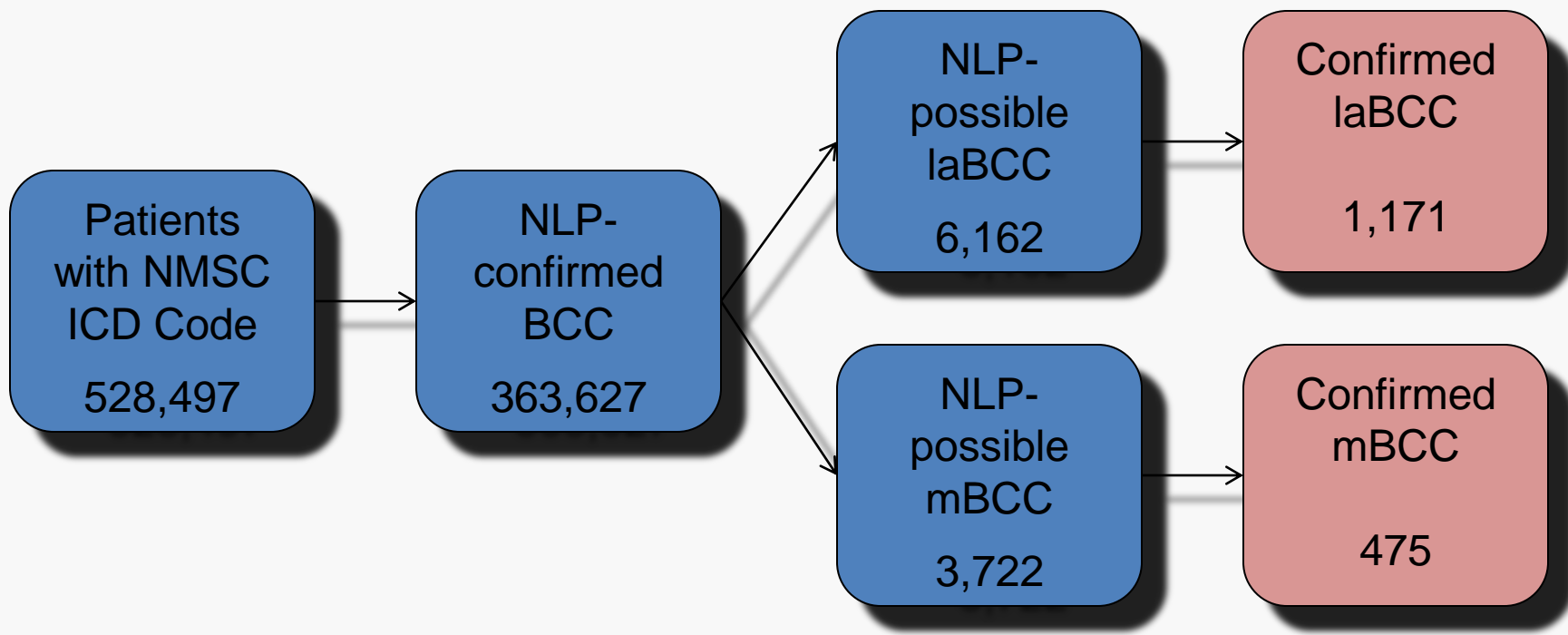
- Leverage existing methods and tools
- Challenges
 - Project team
 - Data access
 - Deployment





More than 1 mention	94%
More than 10 mentions	50%
More than 20 mentions	22%







Questions?

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