Advances in NLP for Clinical Documentation Improvement

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Learning Objectives

At the completion of this program, the learner will be able to:

- describe the steps taken by an NLP processor to identify medical concepts in notes from an EMR
- differentiate between structured and unstructured content in an EMR, and identify the major coding systems that can be used to structure and standardize medical information
- assess the limitations of the information content and organization in their own organization's medical records
- formulate the potential benefits and limitations in applying NLP to the specific EMR-based challenges in their organization

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Five Things to Know about Jon…

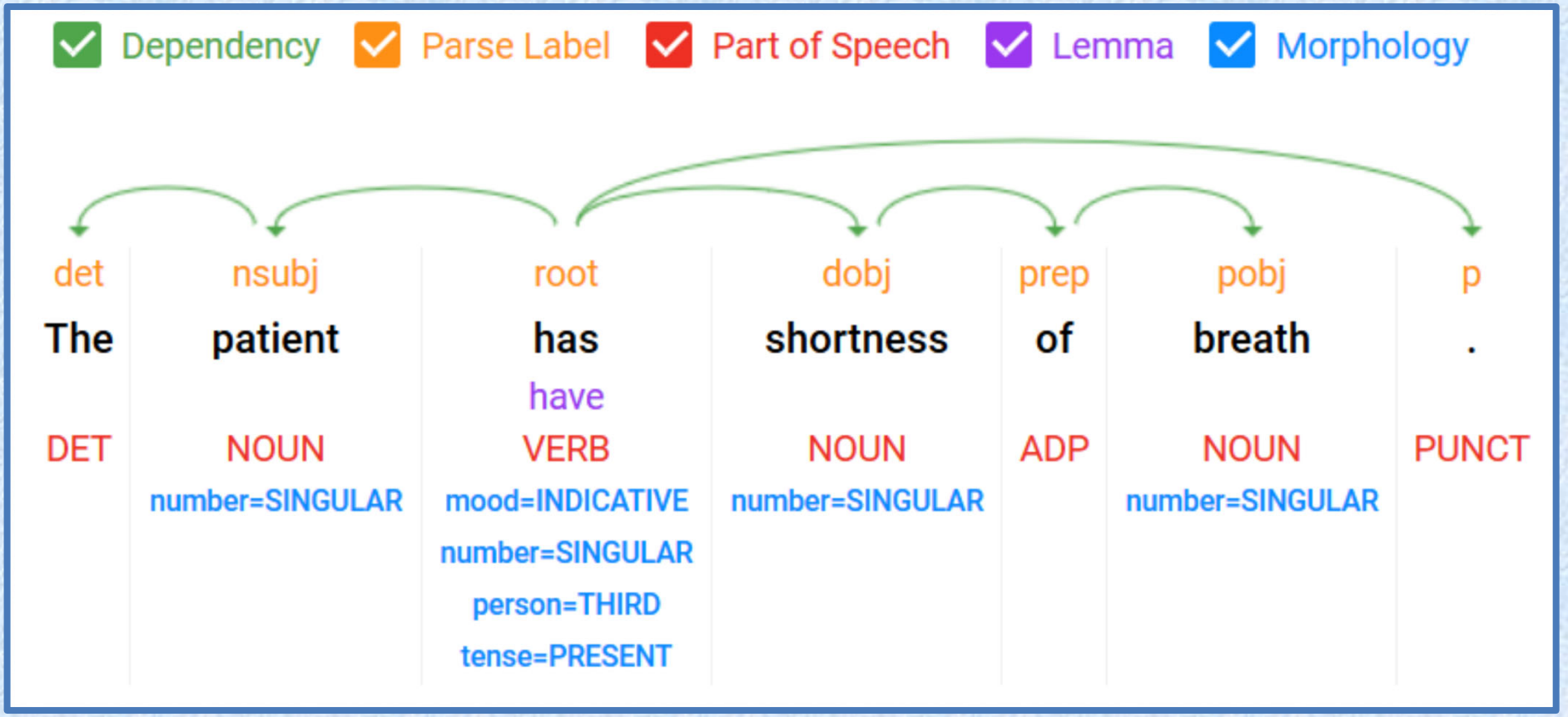
1. **Medical Computing:** Since 1969
2. **Clinical**: Duke-trained cardiologist
3. **Academic:** Clinical Associate Professor at Brown
4. **Administration:** Hospital Boards, Foundation and Finance Committees
5. **Commercial:** Medical software since 1994. Now Chief Innovation Officer of ChartWise Medical Systems (Computer-Assisted Clinical Documentation Improvement)


Foundations of
NLP

My First Experiments with NLP

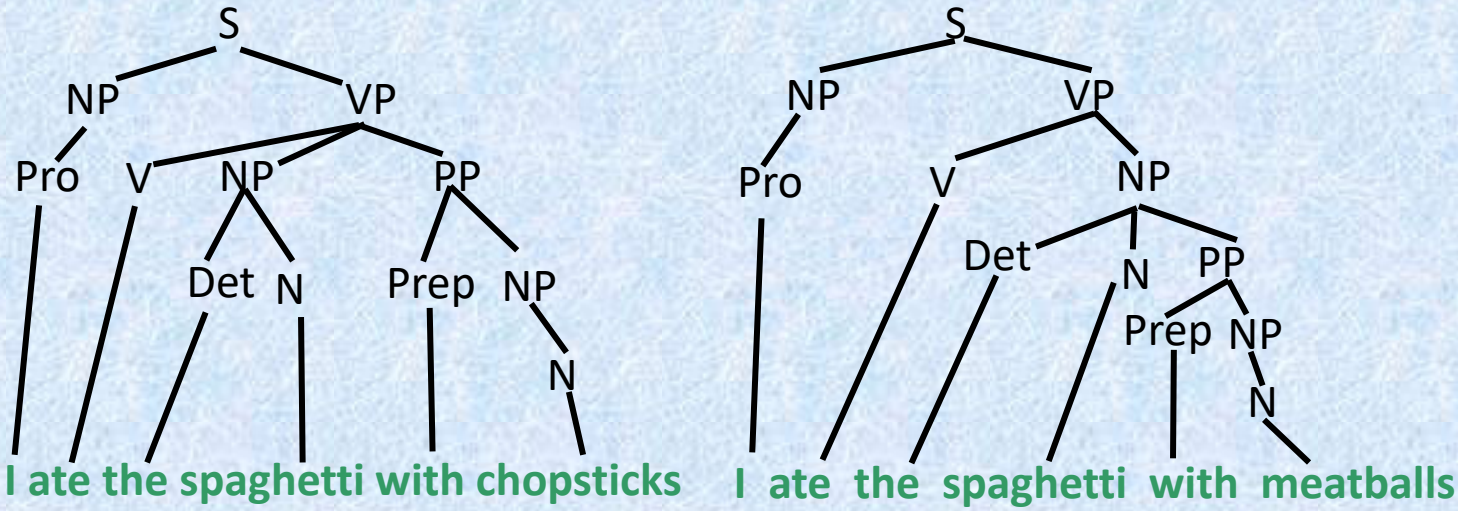
- Implemented Apache's cTAKES (**c**linical **T**ext **A**nalysis **K**nowledge **E**xtraction **S**ystem) NLP engine
- Input the note "*The patient has shortness of breath*"
- The system concluded that:
  - ✓ The patient had shortness (i.e., was "vertically challenged")
  - ✓ The patient was breathing
- The problem: The system had not been trained with a medical vocabulary to know that "shortness of breath" was a single term, aka "dyspnea"

Google's Cloud Natural Language

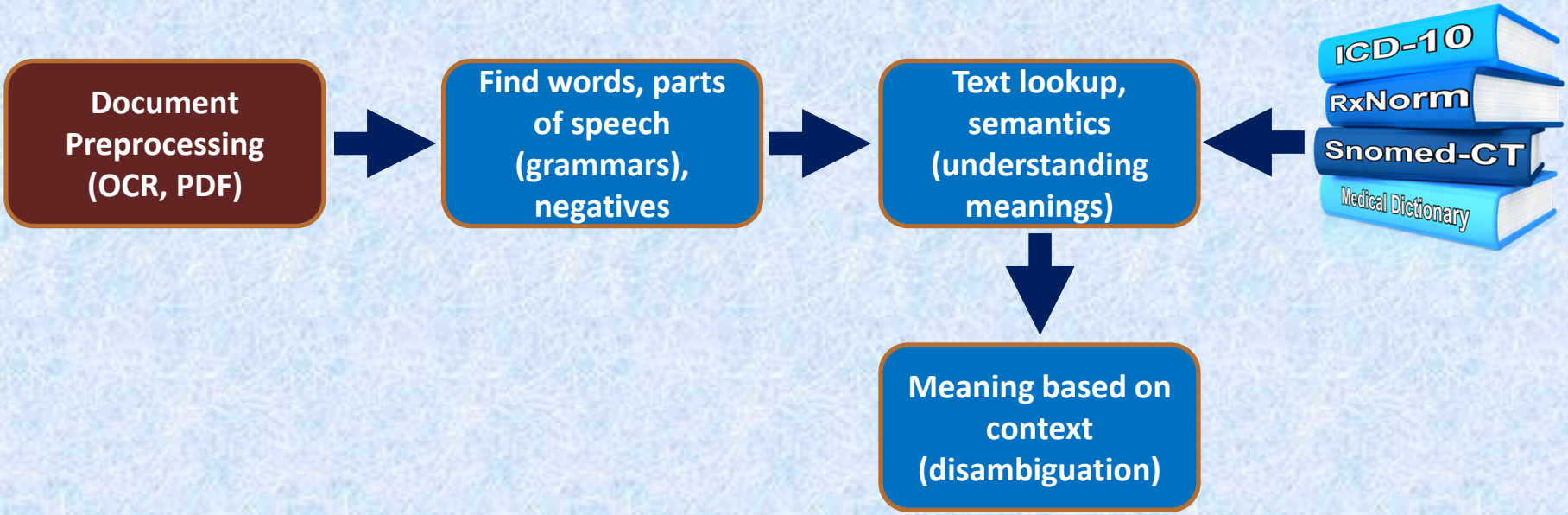


What is Natural Language Processing?

Natural Language Processing (NLP) is a way for computers to analyze, understand, and derive meaning from human language in a smart and useful way.



Typical Components of Medical NLP



FYI: Disambiguation

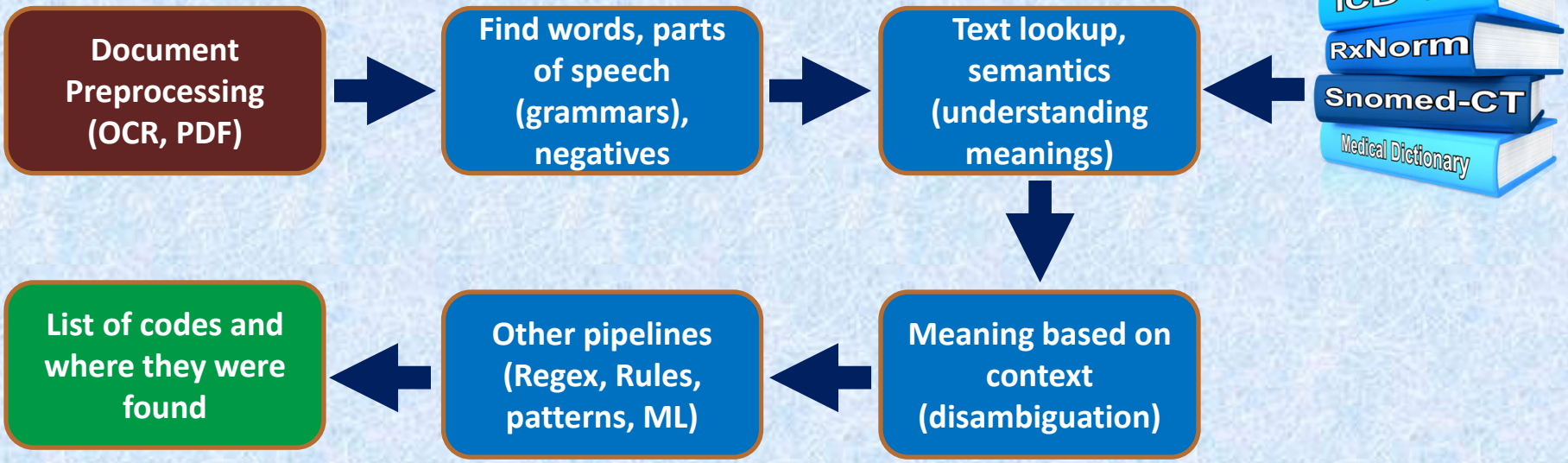
The meaning of “Glucose” depends on the context:

- Test (Glucose Tolerance Test)
- Procedure (Glucose finger stick)
- Test equipment (glucose meter)
- Ingredient (for example in IV infusions)
- Lab finding (from a variety of sites)
- Diagnosis (many)

FYI: Disambiguation

- The meaning of “Acute Kidney Injury” is different in a motor vehicle accident than it is in a Nephrology Consult
- “LTG” might mean “**L**ong-**T**erm **G**oals” in a Physical Therapy note, but “**L**ow **T**ension **G**laucoma” in an Ophthalmology note
- Word-Sense Disambiguation:
  - Paul McCartney likes sea bass
  - Paul McCartney wrote the song’s bass line
  - Paul McCartney plays the bass guitar

Typical Components of Medical NLP



FYI: Acronyms Galore

- Natural Language Processing (NLP)
- Natural Language Understanding (NLU)
- Clinical Language Understanding (CLU)
- Language Understanding Intelligent Services (LUIS)
- Google Cloud AutoML Natural Language
- Computer-Assisted Coding (CAC)

FYI: Code Sets Used for Medical Notes

For Computer-Assisted Coding (CAC):

- **ICD10-CM:** ICD10 Clinical Modifications (Diagnoses)
- **ICD10-PCS:** ICD10 Procedure Codes

For Complete Set of Clinical Findings:

- **SNOMED**: Systematized Nomenclature of Medicine: Symptoms, physical exam, labs, image results, meds, diagnoses, procedures
- **RxNorm**: A normalized naming system for drugs
- **LOINC**: Logical Observation Identifiers Names and Codes (observations, lab and imaging results)

Putting “Medical NLP” to Work

- Signs – Physical Exam Findings (SNOMED)
- Patient Symptoms (SNOMED)
- Medications and dosages (RxNorm, SNOMED)
- Lab and imaging results (LOINC, SNOMED)
- Diagnoses (ICD10-CM, SNOMED)
- Procedures (ICD10-PCS, SNOMED)

Common Medical Terminologies

- **SNOMED: Systematized Nomenclature of Medicine**
- **ICD10: International Classification of Disease (World Health organization)**
- **LOINC: Logical Observation Identifiers Names and Codes**
- **RxNorm: Clinical Drugs (National Library of Medicine)**
- CPT: Current Procedural Terminology (American Medical Association)
- HCPCS: Healthcare Common Procedure Coding System (CMS), extends CPT
- MeSH: Medical Subject Headings (National Library of Medicine)
- MedDRA: Medical Dictionary for Regulatory Activities
- NCI: National Cancer Institute
- UNII: Unique Ingredient Identifier (FDA)
- NDDF: National Drug Data File
- RadLex: Radiology Lexicon

UMLS: One Ontology to Rule Them All

Unified Medical Language System

UMLS English Language Terminologies (Partial)

AI/RHEUM
Alcohol and Other Drug Thesaurus
Alternative Billing Concepts
Anatomical Therapeutic Chemical Classification System
Authorized Osteopathic Thesaurus
Beth Israel Problem List
BioCarta online maps of molecular pathways, adapted for NCI
Biomedical Research Integrated Domain Group Model
Cancer Research Center of Hawaii Nutrition Terminology
Cancer Therapy Eval Program - Simple Disease Classification
CDISC Terminology
CDT
Chemical Biology and Drug Development Vocabulary
Clinical Care Classification
Clinical Classifications Software
Clinical Concepts by R A Miller
Clinical Problem Statements
Clinical Proteomic Tumor Analysis Consortium
Clinical Trials Reporting Program Terms
Common Terminology Criteria for Adverse Events 5.0
Congenital Mental Retardation Syndromes
Consumer Health Vocabulary
Content Archive Resource Exchange Lexicon
COSTAR
COSTART
CPT - Current Procedural Terminology
CRISP Thesaurus
Diagnostic and Statistical Manual of Mental Disorders, 5th Ed
Digital Anatomist
DICOM Digital Imaging Communications in Medicine Terms
Diseases Database
DrugBank
DXplain
European Dir. for Quality of Medicines & Healthcare Terms
FDA
FDB MedKnowledge
Foundational Model of Anatomy
Gene Ontology
Geopolitical Entities, Names & Codes (GENC) Standard Ed. 1
Global Align. of Immun.Safety Assessment in Pregnancy
Glossary of Clinical Epidemiologic Terms
Gold Standard Drug Database
HCPCS - Healthcare Common Procedure Coding System
HL7
HUGO Gene Nomenclature Committee
Human Phenotype Ontology
ICD-10 Procedure Coding System
ICPC
ICPC2E
International Classification for Nursing Practice
International Classification of Functioning, Disability & Health
International Classification of Primary Care, 2nd Edition
International Conference on Harmonization Terms
International Neonatal Consortium
Jackson Laboratories Mouse Terminology, adapted for NCI
KEGG Pathway Database Terms
Library of Congress Subject Headings
LOINC
Manufacturers of Vaccines
MEDCIN
MedDRA
Medical Entities Dictionary
Medication Reference Terminology
MedlinePlus Health Topics
MeSH
Metathesaurus CMS Formulary Reference File
Micromedex
Multum
NANDA-I Taxonomy
National Drug File
National Uniform Claims - Health Care Provider Taxonomy
NCBI Taxonomy
NCI (multiple)
NCPDP Terminology
Neuronames Brain Hierarchy
NICHD Terminology
Nursing Interventions Classification
Nursing Outcomes Classification
Omaha System
Online Mendelian Inheritance in Man
Patient Care Data Set
Perioperative Nursing Data Set
Pharmacy Practice Activity Classification
Physician Data Query
Prostate Imaging Reporting and Data System Terms
Psychological Index Terms
Quick Medical Reference
Read Codes
Registry Nomenclature Information System
RXNORM
SNOMED CT
Source of Payment Typology
Standard Product Nomenclature
U.S. Centers for Disease Control and Prevention Terms
UltraSTAR
UMDNS
Unified Code for Units of Measure
USP Compendial Nomenclature
USP Model Guidelines
Vaccines Administered
WHOART
Zebrafish Model Organism Database Terms

FYI: Lexicon vs. Taxonomy vs. Ontology

- **Lexicon** is the vocabulary of a branch of knowledge (like Radiology's RadLex)
- **Taxonomy** is usually only a hierarchy of concepts (i.e. the only relation is parent/child). It prescribes structure and terminology (ICD10 is a taxonomy)
- **Ontology** (like UMLS) identifies and distinguishes concepts and their relationships (*X is_married_to Y*; or *A contains B*; or *C is_ingredient_in D*, etc.)

FYI: Pre-Coordinated vs. Post-Coordinated

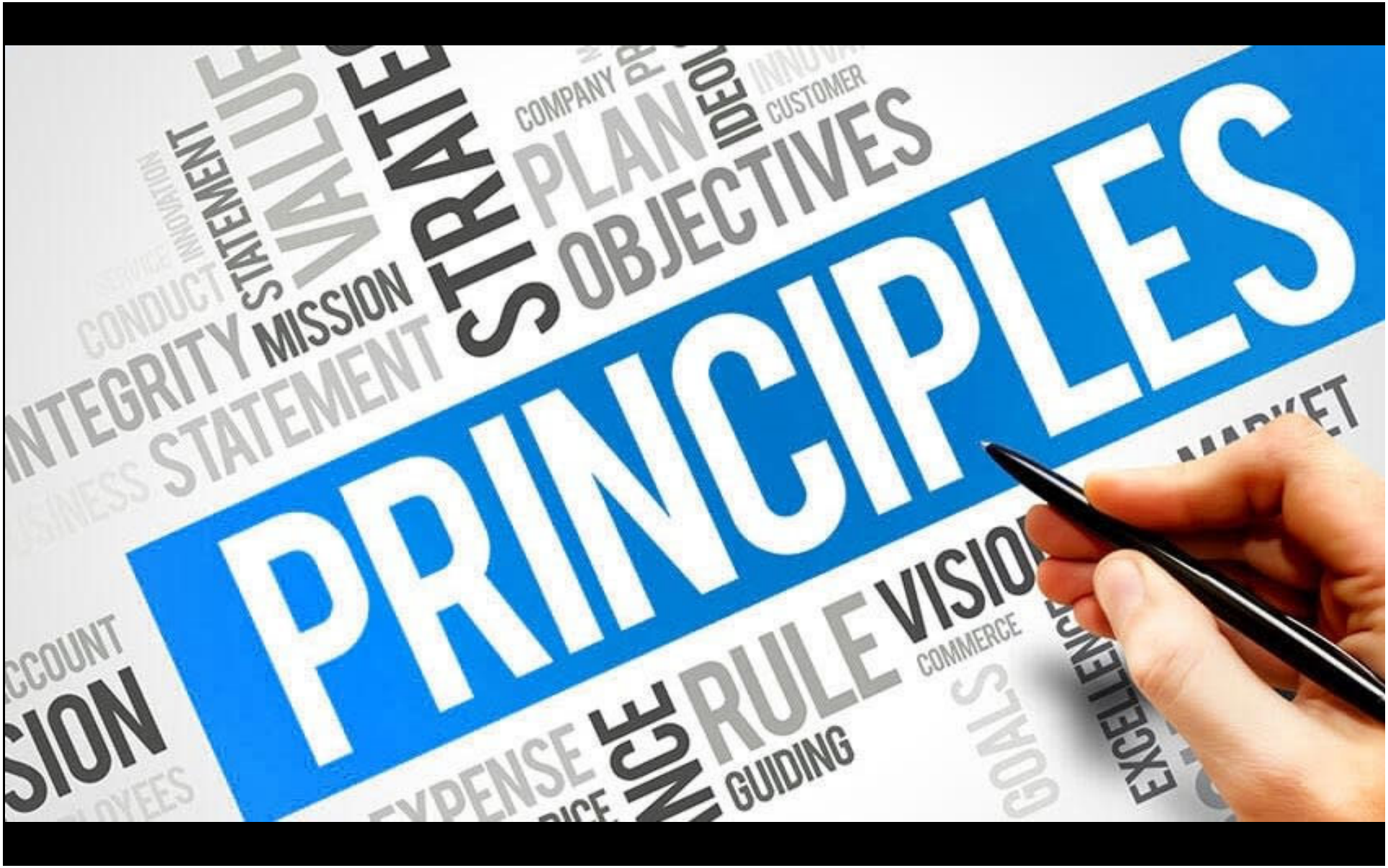
Pre-Coordinated:

- RxNorm #200809 Furosemide 40 MG Oral Tablet [Lasix]

Post-Coordinated (all terms are needed):

- Ingredient: Furosemide
- Dosage From: Oral Tablet
- Dose: 40
- Unit of measure: milligrams


Implementing
NLP

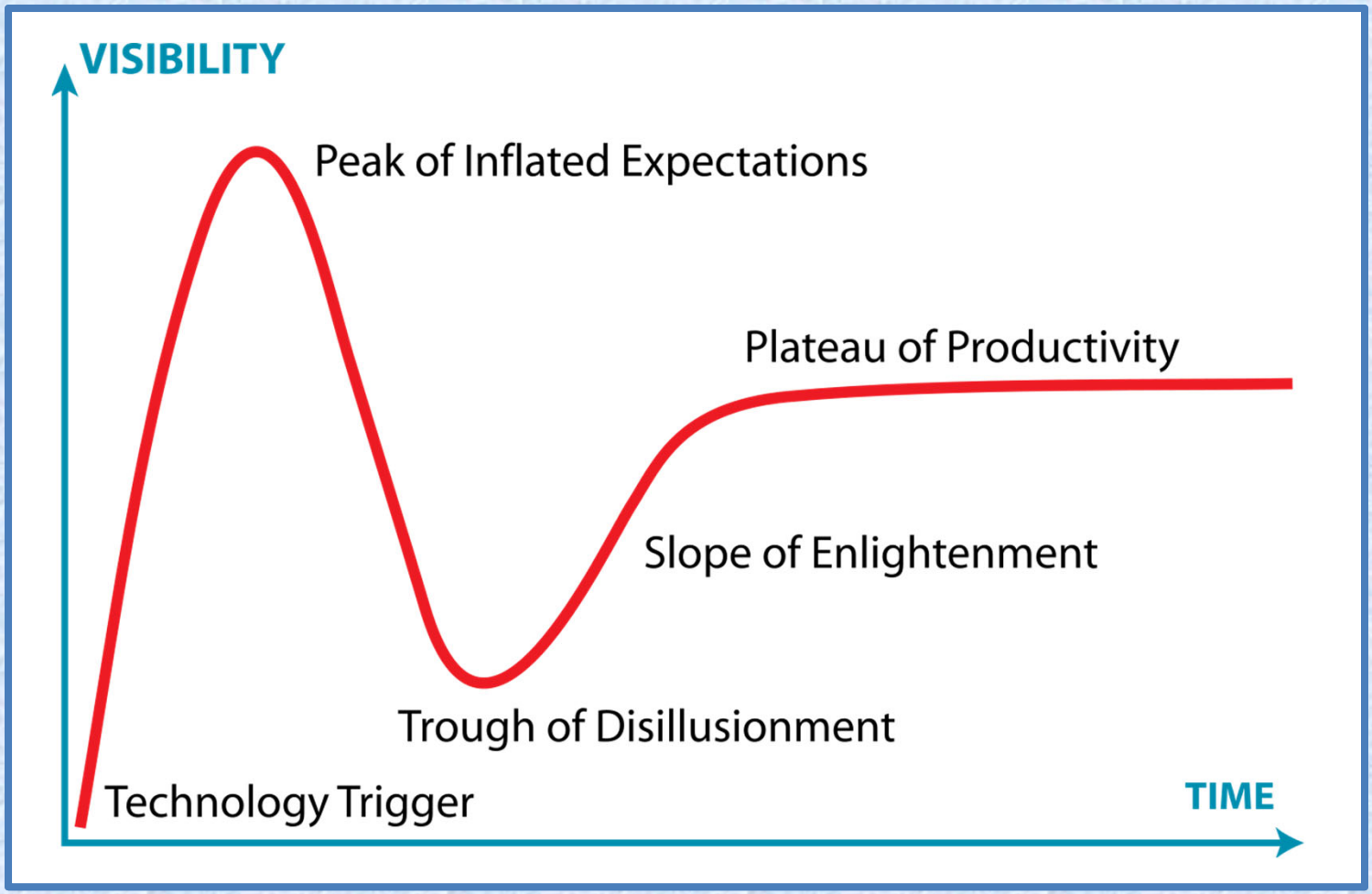

PRINCIPLES
STRATEGY
VALUE
STATEMENT
MISSION
INTEGRITY
OBJECTIVES
PLAN
COMPANY
CUSTOMER
RULE
VISION
COMMERCE
GUIDING
EXPENSE
EXCELLENCE
GOALS

Implementing NLP

- You *always* need a workflow that reviews the codes found (and, verifies, adds, deletes changes them)
- Identify all the sources and formats of all textual clinical data (more than just the EMR!)
- Work with Medical Informatics ("Terminologist," either vendor-based or in-house) to improve the NLP results
- Study the timeliness of the results that is needed, and design information flows to meet these goals


Limitations of
NLP

Emerging Technologies: Gartner Hype Cycle



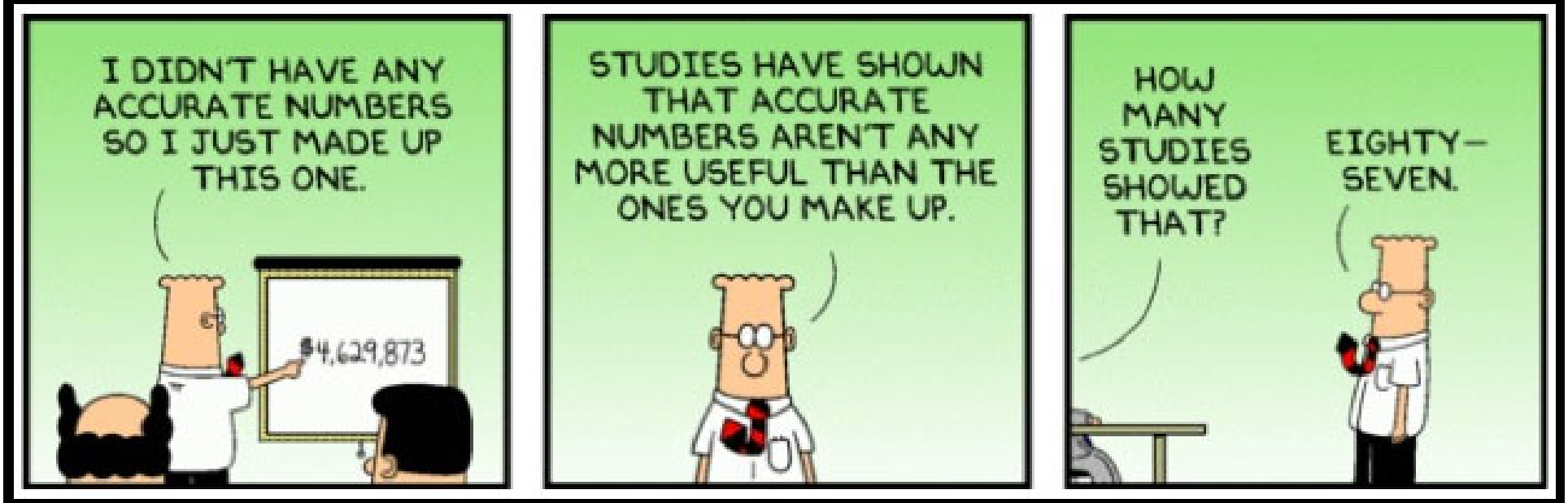
Over-Inflated Expectations?

A healthcare/data network made the following claims about NLP:

- helps doctors spend more time with patients
- extracts and interprets data accurately
- increases patient engagement and involvement
- helps to deliver value-based care
- improves care coordination
- helps staff collect all critical data quickly and correctly
- spots errors in documentation and makes suggestions
- increases revenues

FYI: Accuracy and Precision

- **Precision:** the percentage of the codes the system picks up that are correct versus incorrect
- **Accuracy:** the percentage of findings that the NLP system automatically finds versus how many it was "supposed" to find. Human review is considered the gold (albeit tarnished) standard


I DIDN'T HAVE ANY ACCURATE NUMBERS SO I JUST MADE UP THIS ONE.
$4,629,873
STUDIES HAVE SHOWN THAT ACCURATE NUMBERS AREN'T ANY MORE USEFUL THAN THE ONES YOU MAKE UP.
HOW MANY STUDIES SHOWED THAT?
EIGHTY-SEVEN.

Limitations of NLP

- NLP is a tool, not a solution
- NLP is not perfect – you *always* need a workflow that reviews the codes found
- NLP is strongest when fine-tuned to a narrow focus
- Finding and connecting to all sources of clinical data can be time-consuming and complex
- End-users (such as production coders) may get easily frustrated, especially with the imperfections


The Magic of
NLP

The NEW ENGLAND JOURNAL of MEDICINE

SPECIAL ARTICLE

MEDICAL RECORDS THAT GUIDE AND TEACH

LAWRENCE L. WEED, M.D.

Weed, L.L. Medical Records That Guide and Teach.
New Engl. J. Med, 278:593-600 and 652-657, 1968

Problem-Oriented Medical Record (POMR)

- Dr. Lawrence Weed pioneered the Problem-Oriented Medical Record, forever changing the way physicians wrote and used medical documentation.
- In his landmark 1968 essay in the New England Journal of Medicine, he wrote:

At present the physician has to read the entire record … and then sort the data in his mind if he is to know all the patient's difficulties and the extent to which each has been analyzed … He and others using the record lose their way, and problems get neglected, missed entirely or treated out of context…

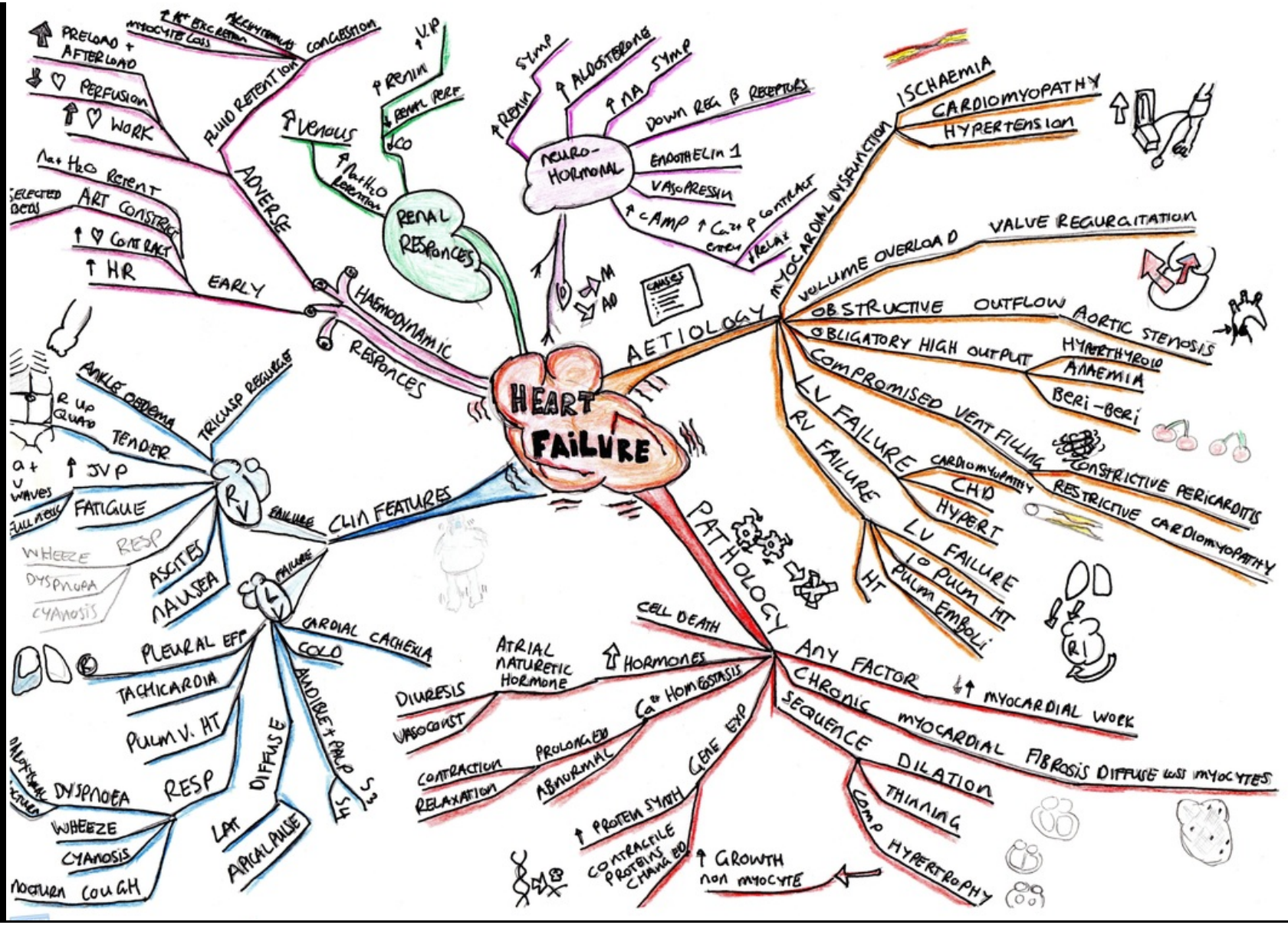
Problem-Oriented Medical Record (POMR)

At present no system is available whereby a medical teacher or member of an accrediting agency can take a patient's record at random, select one of the patient's problems, see all the data pertinent to that problem in sequence and immediately ascertain whether current medical standards are being applied.

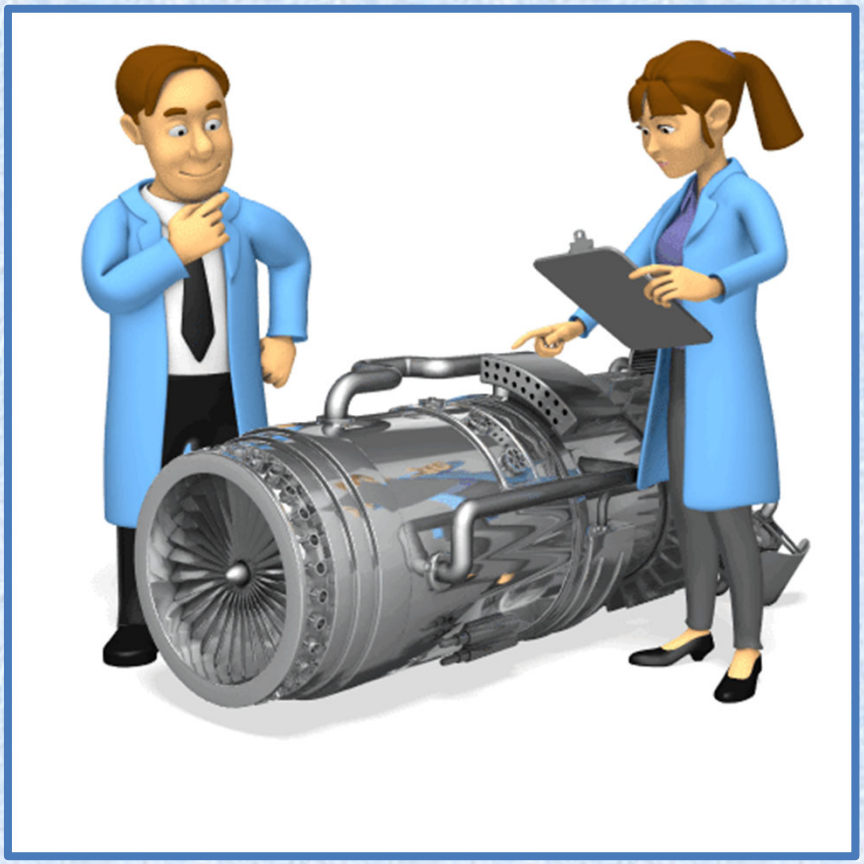
It took over 50 years to get there, but…

Topic-Oriented Navigation: The Problem

- “Note Bloat” has made it difficult for clinicians and others to do a true problem-oriented chart review
- Reviewing NLP (and CAC) findings can be burdensome
- CDI staff and other chart reviewers have massive amounts of information to sift through
- Denials based on “Clinical Validation” are on the rise
- Coders are challenged to find the evidence to support codes


HEART FAILURE
AETIOLOGY
ISCHAEMIA
CARDIOMYOPATHY
HYPERTENSION
MYOCARDIAL DYSFUNCTION
VOLUME OVERLOAD
VALVE REGURGITATION
OBSTRUCTIVE OUTFLOW
AORTIC STENOSIS
OBLIGATORY HIGH OUTPUT
HYPERTHYROID
ANAEMIA
BERI-BERI
COMPROMISED VENT FILLING
CONSTRICTIVE PERICARDITIS
RESTRICTIVE CARDIOMYOPATHY
LV FAILURE
RV FAILURE
CARDIOMYOPATHY
CHD
HYPERT
LV FAILURE
↑ PULM HT
PULM EMBOLI
HT
PATHOLOGY
ANY FACTOR
↓↑ MYOCARDIAL WORK
CHRONIC MYOCARDIAL FIBROSIS
DIFFUSE ↓ MYOCYTES
SEQUENCE
DILATION
THINNING
COMP HYPERTROPHY
CELL DEATH
HORMONES
ATRIAL NATURETIC HORMONE
DIURESIS
VASOCONST
Ca++ HOMEOSTASIS
PROLONGED
ABNORMAL
CONTRACTION
RELAXATION
GENE EXP
↑ PROTEIN SYNTH
CONTRACTILE PROTEINS CHANGED
↑ GROWTH NON MYOCYTE
CLIN FEATURES
RV FAILURE
ANKLE OEDEMA
TRICUSP REGURGE
R UP QUAD TENDER
↑ JVP
a+v WAVES
FATIGUE
ASCITES
NAUSEA
LV FAILURE
CARDIAL CACHEXIA
COLD
PLEURAL EFF
TACHICARDIA
PULM V. HT
RESP
DYSPNOEA
WHEEZE
CYANOSIS
NOCTURN COUGH
DIFFUSE
LAT APICAL PULSE
AUDIBLE S4
PALP S4
RESP
WHEEZE
DYSPNOEA
CYANOSIS
HAEMODYNAMIC RESPONCES
ADVERSE
PRELOAD + AFTERLOAD
↓ PERFUSION
↑ WORK
FLUID RETENTION
CONGESTION
ARRHYTHMIAS
↓↑ MYOCYTE LOSS
↓ ART CONSTRICT
↑ CONTRACT
↑ HR
EARLY
RENAL RESPONCES
↑ VENOUS
↑ V.P
↑ RENIN
↓ RENAL PERF
↓ CO
↑ Na+ H2O RETENT
↓ Na+ H2O EXCRETION
NEURO-HORMONAL
↑ RENIN
SYMP
↑ ALDOSTERONE
↑ NA
SYMP
DOWN REG β RECEPTORS
ENDOTHELIN 1
VASOPRESSIN
↑ cAMP ↑ Ca2+ ↓ CONTRACT
RELAX
CAUSES
↓ M
↓ AO

Engine Parts: Topics, Concepts & Findings



The basic NLP “engine” needs to be super-charged with:

- ✓ Findings
- ✓ Concepts
- ✓ Topics

Topics, Concepts and Findings

Findings: The coded equivalent of text strings that describe signs, symptoms, lab and imaging results, medications, diagnoses and procedures. Examples:

- Acute Myocardial Infarction, unspecified (ICD10-CM I21.9)
- Pressure ulcer of right lower back stage 3 (ICD10-CM L89.133)
- Paroxysmal Nocturnal Dyspnea (SNOMED 55442000)
- Furosemide 40 MG Oral Tablet [Lasix] (RxNorm 200809)
- **Serum sodium level normal (SNOMED 166692000)**
- **Sodium [Moles/volume] in Serum or Plasma (LOINC 2951-2)**

Topics, Concepts and Findings

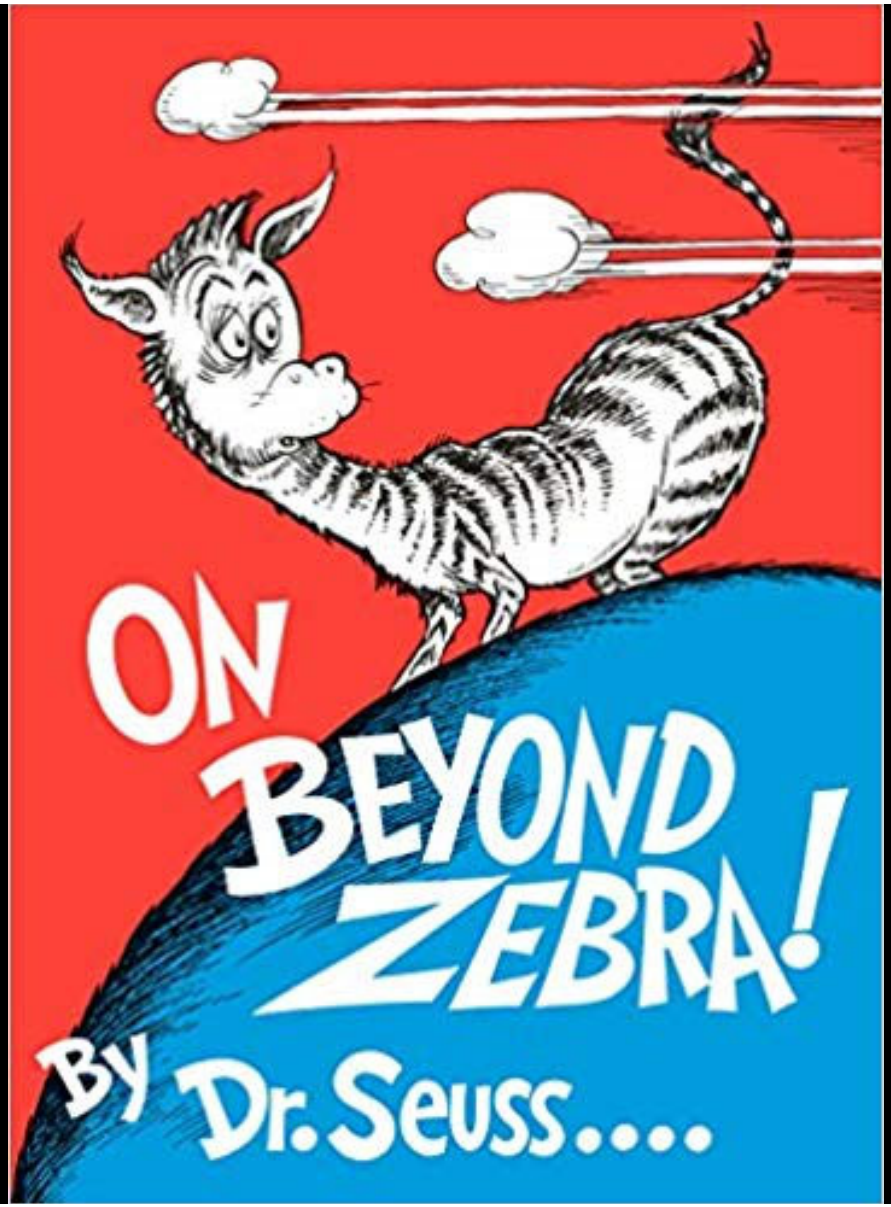
Concepts: A collection of Findings that all pertain to a specific medical concept describing signs, symptoms, lab and imaging results, medications, diagnoses and procedures. For example, the concept EDEMA could include:

- ✓ Anasarca (SNOMED 442433009)
- ✓ Peripheral edema (SNOMED 271809000)
- ✓ Ankle edema (SNOMED 26237000)
- ✓ Pitting edema (SNOMED 284521000
- ✓ No edema present (SNOMED 161980004)
- ✓ Edema, generalized (SNOMED 271808008)
- ✓ 2+ pitting edema (SNOMED 421605005)

Concept for the Diagnosis of CHF

- I11.0 Hypertensive heart disease with heart failure
- I13.0 Hypertensive heart & chronic kidney disease with heart failure & stage 1-4 CKD
- I13.2 Hypertensive heart & chronic kidney disease with heart failure & stage 5 CKD or ESRD
- I50.9 Heart failure, unspecified
- I50.20 Unspecified systolic (congestive) heart failure
- I50.21 Acute systolic (congestive) heart failure
- I50.22 Chronic systolic (congestive) heart failure
- I50.23 Acute on chronic systolic (congestive) heart failure
- I50.30 Unspecified diastolic (congestive) heart failure
- I50.31 Acute diastolic (congestive) heart failure
- I50.32 Chronic diastolic (congestive) heart failure
- I50.33 Acute on chronic diastolic (congestive) heart failure
- I50.40 Unspecified combined systolic (congestive) and diastolic (congestive) heart failure
- I50.41 Acute combined systolic (congestive) and diastolic (congestive) heart failure
- I50.42 Chronic combined systolic (congestive) and diastolic (congestive) heart failure
- I50.43 Acute on chronic combined systolic (congestive) and diastolic (congestive) heart failure

…

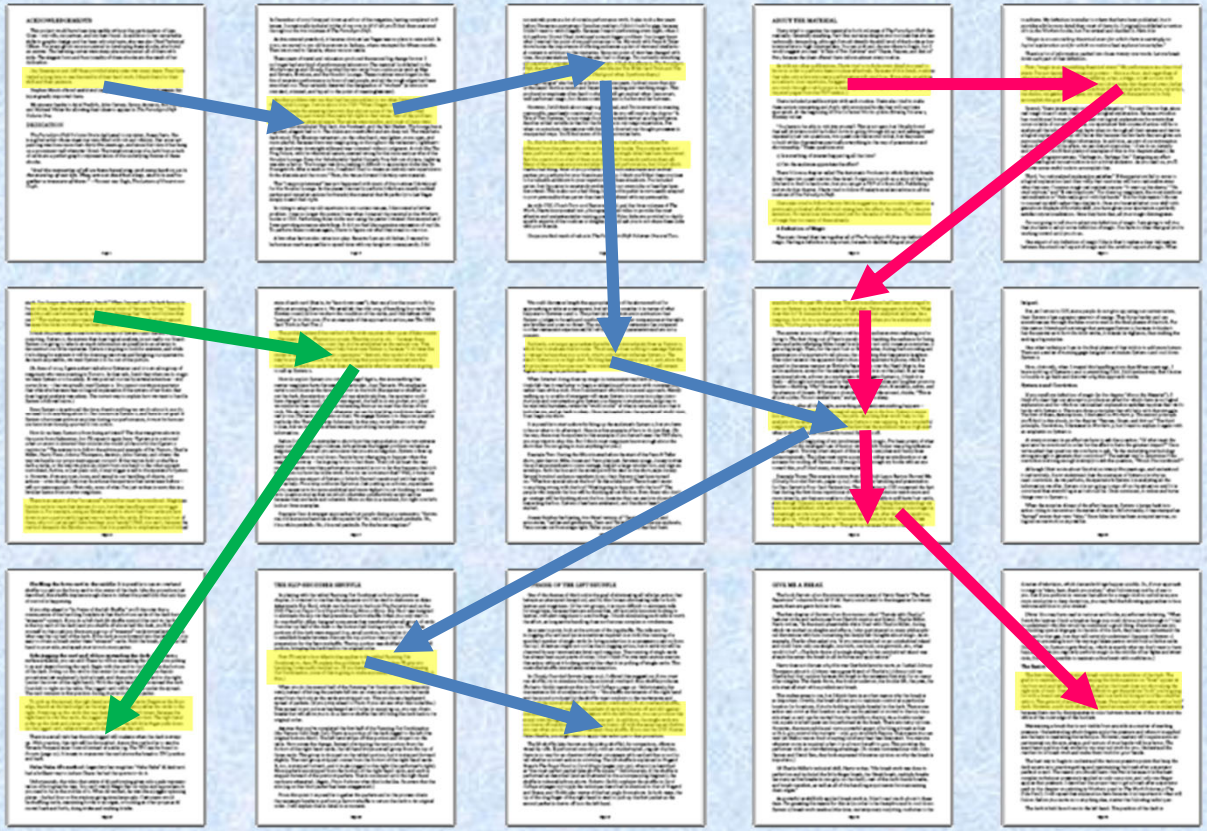

ON BEYOND ZEBRA!
By Dr. Seuss....

Topics, Concepts and Findings

Topics: A collection concepts that together describe a clinical Topic or Problem. For example, the topic CHF might include these Concepts:

- ✓ Chest x-ray
- ✓ Actual diagnosis of Congestive Heart Failure
- ✓ Blood Markers (BNP, pro-BNP, Galectin-3)
- ✓ Diuretics
- ✓ Dyspnea (paroxysmal nocturnal, on exertion or orthopnea)
- ✓ Edema and Ascites
- ✓ Ejection Fraction
- ✓ Neck veins and Jugular Venous Distension
- ✓ Rales

Topic-Oriented Navigation



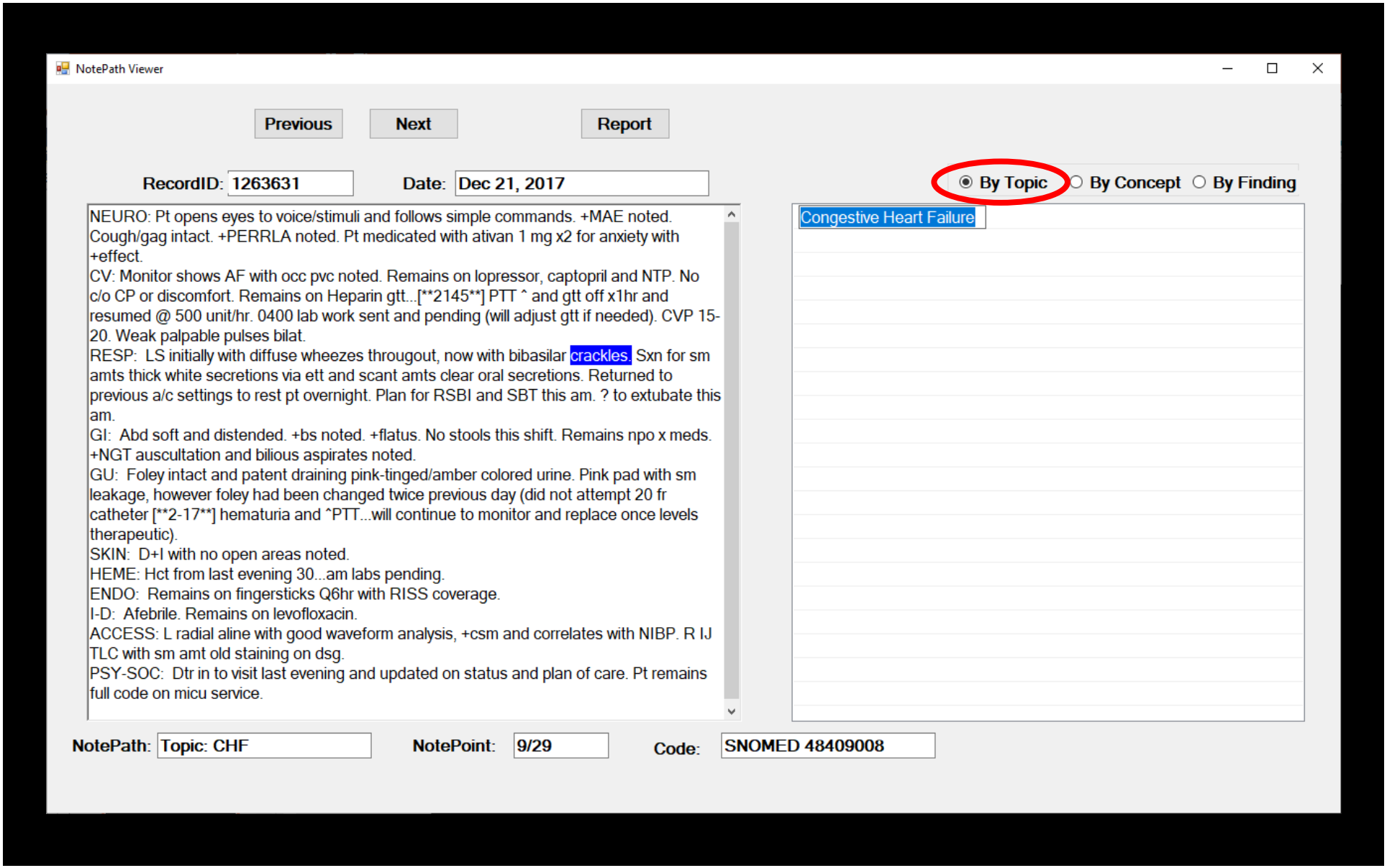
- All Clinical notes analyzed by advanced NLP
- Findings identified (“Note Points”): signs, symptoms, labs, meds, diagnoses, procedures.
- A Path is a sequence of Note Points that navigate through a Topic, Concept or Finding
- Each Topic, Concept and Finding has its own Path

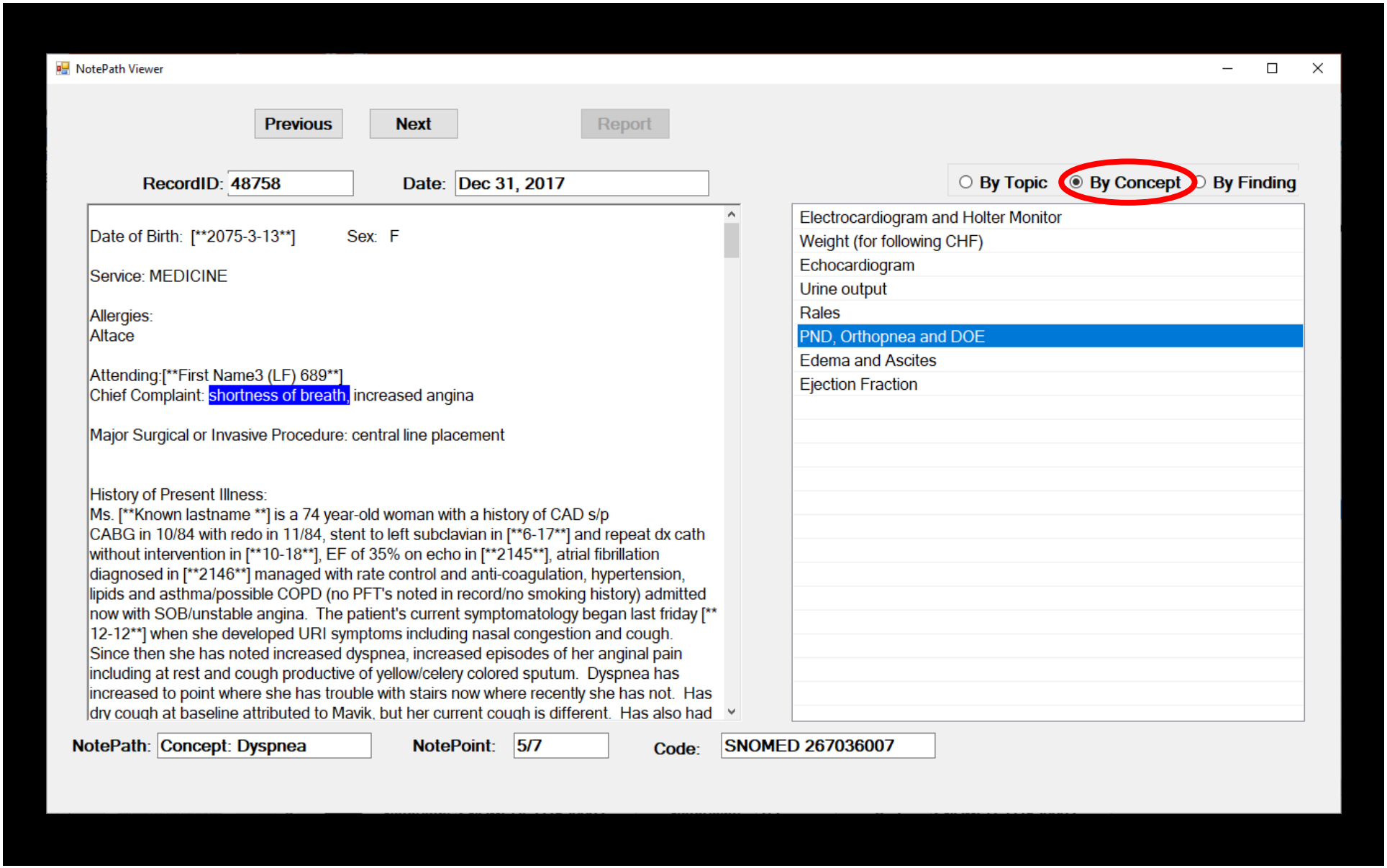
FYI: Concept: Diuretics

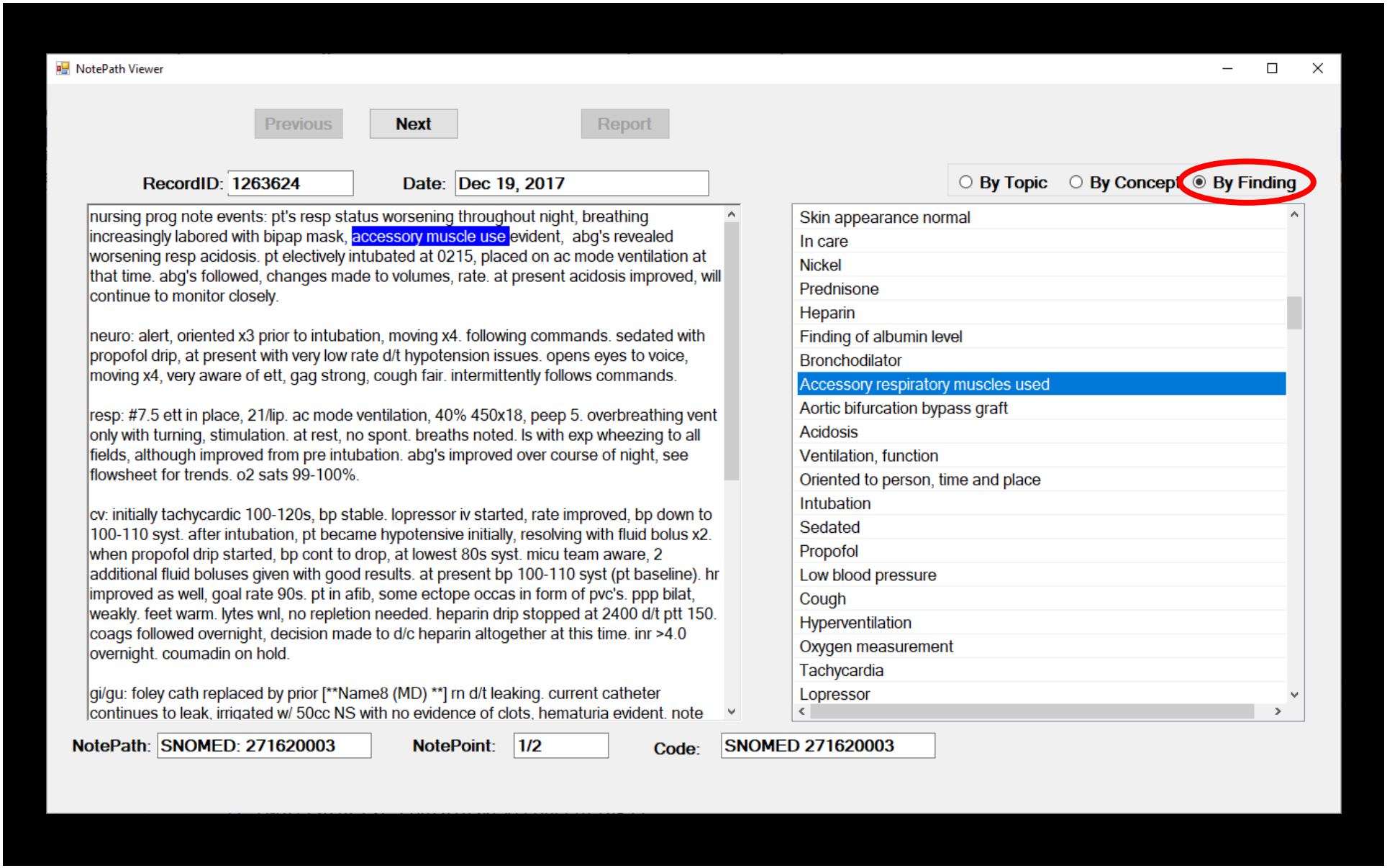
RxNorm 1006894 Hydrochlorothiazide / Sotalol
RxNorm 1006959 dehydrosanol / Triamterene
RxNorm 1006960 Mefruside / Reserpine
RxNorm 1006994 piretanide / Ramipril
RxNorm 1007001 Mefruside / Nifedipine
RxNorm 1007003 Acebutolol / Mefruside
RxNorm 1007010 Methyclothiazide / Triamterene
RxNorm 1007083 Diltiazem / Hydrochlorothiazide
RxNorm 1007225 Triamterene / Xipamide
RxNorm 1007236 cyclothiazide / Triamterene
RxNorm 1007340 Chlorthalidone / Metoprolol
RxNorm 1007360 Hydrochlorothiazide / Pindolol
RxNorm 1007699 Clopamide / Reserpine
RxNorm 1007929 Hydrochlorothiazide / Triamterene / Verapamil
RxNorm 1008043 conivaptan / Glucose…

Topic: Congestive Heart Failure

- Congestive Heart Failure
- Diuretics
- Orthopnea
- Nocturnal Dyspnea
- Shortness of breath
- Dyspnea on exertion
- Fatigue
- Ascites
- Anasarca
- Pitting edema
- Jugular veins
- Elevated BNP
- Inputs and Outputs
- Daily weights
- ECG
- Holter monitor
- Stress test
- Cardiac catheterization
- Cardiac angiography
- Cardiac MRI
- Low-salt diet
- Restricted fluid intake
- ACE
- aldosterone antagonists
- ARB
- beta blockers
- digoxin
- isosorbide dinitrate
- hydralazine
- AICD
- CRT
- LVAD
- Dialysis
- Peripheral edema
- Pulmonary râles
- BNP
- BUN
- Creatinine
- Galectin-3, ST2
- Serum potassium
- Serum sodium
- Electrocardiogram
- Chest x-ray
- Echocardiogram
- Ejection fraction


NotePath Viewer
Previous
Next
Report
RecordID: 1263631
Date: Dec 21, 2017
By Topic
By Concept
By Finding
NEURO: Pt opens eyes to voice/stimuli and follows simple commands. +MAE noted. Cough/gag intact. +PERRLA noted. Pt medicated with ativan 1 mg x2 for anxiety with +effect.
CV: Monitor shows AF with occ pvc noted. Remains on lopressor, captopril and NTP. No c/o CP or discomfort. Remains on Heparin gtt...[**2145**] PTT ^ and gtt off x1hr and resumed @ 500 unit/hr. 0400 lab work sent and pending (will adjust gtt if needed). CVP 15-20. Weak palpable pulses bilat.
RESP: LS initially with diffuse wheezes througout, now with bibasilar crackles. Sxn for sm amts thick white secretions via ett and scant amts clear oral secretions. Returned to previous a/c settings to rest pt overnight. Plan for RSBI and SBT this am. ? to extubate this am.
GI: Abd soft and distended. +bs noted. +flatus. No stools this shift. Remains npo x meds. +NGT auscultation and bilious aspirates noted.
GU: Foley intact and patent draining pink-tinged/amber colored urine. Pink pad with sm leakage, however foley had been changed twice previous day (did not attempt 20 fr catheter [**2-17**] hematuria and ^PTT...will continue to monitor and replace once levels therapeutic).
SKIN: D+I with no open areas noted.
HEME: Hct from last evening 30...am labs pending.
ENDO: Remains on fingersticks Q6hr with RISS coverage.
I-D: Afebrile. Remains on levofloxacin.
ACCESS: L radial aline with good waveform analysis, +csm and correlates with NIBP. R IJ TLC with sm amt old staining on dsg.
PSY-SOC: Dtr in to visit last evening and updated on status and plan of care. Pt remains full code on micu service.
Congestive Heart Failure
NotePath: Topic: CHF
NotePoint: 9/29
Code: SNOMED 48409008


NotePath Viewer
Previous
Next
Report
RecordID: 48758
Date: Dec 31, 2017
By Topic
By Concept
By Finding
Date of Birth: [**2075-3-13**] Sex: F
Service: MEDICINE
Allergies:
Altace
Attending:[**First Name3 (LF) 689**]
Chief Complaint: shortness of breath increased angina
Major Surgical or Invasive Procedure: central line placement
History of Present Illness:
Ms. [**Known lastname **] is a 74 year-old woman with a history of CAD s/p
CABG in 10/84 with redo in 11/84, stent to left subclavian in [**6-17**] and repeat dx cath
without intervention in [**10-18**], EF of 35% on echo in [**2145**], atrial fibrillation
diagnosed in [**2146**] managed with rate control and anti-coagulation, hypertension,
lipids and asthma/possible COPD (no PFT's noted in record/no smoking history) admitted
now with SOB/unstable angina. The patient's current symptomatology began last friday [**
12-12**] when she developed URI symptoms including nasal congestion and cough.
Since then she has noted increased dyspnea, increased episodes of her anginal pain
including at rest and cough productive of yellow/celery colored sputum. Dyspnea has
increased to point where she has trouble with stairs now where recently she has not. Has
dry cough at baseline attributed to Mavik, but her current cough is different. Has also had
Electrocardiogram and Holter Monitor
Weight (for following CHF)
Echocardiogram
Urine output
Rales
PND, Orthopnea and DOE
Edema and Ascites
Ejection Fraction
NotePath: Concept: Dyspnea
NotePoint: 5/7
Code: SNOMED 267036007


NotePath Viewer
Previous
Next
Report
RecordID: 1263624
Date: Dec 19, 2017
By Topic
By Concept
By Finding
nursing prog note events: pt's resp status worsening throughout night, breathing increasingly labored with bipap mask, accessory muscle use evident, abg's revealed worsening resp acidosis. pt electively intubated at 0215, placed on ac mode ventilation at that time. abg's followed, changes made to volumes, rate. at present acidosis improved, will continue to monitor closely.
neuro: alert, oriented x3 prior to intubation, moving x4. following commands. sedated with propofol drip, at present with very low rate d/t hypotension issues. opens eyes to voice, moving x4, very aware of ett, gag strong, cough fair. intermittently follows commands.
resp: #7.5 ett in place, 21/lip. ac mode ventilation, 40% 450x18, peep 5. overbreathing vent only with turning, stimulation. at rest, no spont. breaths noted. ls with exp wheezing to all fields, although improved from pre intubation. abg's improved over course of night, see flowsheet for trends. o2 sats 99-100%.
cv: initially tachycardic 100-120s, bp stable. lopressor iv started, rate improved, bp down to 100-110 syst. after intubation, pt became hypotensive initially, resolving with fluid bolus x2. when propofol drip started, bp cont to drop, at lowest 80s syst. micu team aware, 2 additional fluid boluses given with good results. at present bp 100-110 syst (pt baseline). hr improved as well, goal rate 90s. pt in afib, some ectope occas in form of pvc's. ppp bilat, weakly. feet warm. lytes wnl, no repletion needed. heparin drip stopped at 2400 d/t ptt 150. coags followed overnight, decision made to d/c heparin altogether at this time. inr >4.0 overnight. coumadin on hold.
gi/gu: foley cath replaced by prior [**Name8 (MD) **] rn d/t leaking. current catheter continues to leak, irrigated w/ 50cc NS with no evidence of clots, hematuria evident, note
Skin appearance normal
In care
Nickel
Prednisone
Heparin
Finding of albumin level
Bronchodilator
Accessory respiratory muscles used
Aortic bifurcation bypass graft
Acidosis
Ventilation, function
Oriented to person, time and place
Intubation
Sedated
Propofol
Low blood pressure
Cough
Hyperventilation
Oxygen measurement
Tachycardia
Lopressor
NotePath: SNOMED: 271620003
NotePoint: 1/2
Code: SNOMED 271620003

Clinical Validation Sample Report

Clinical Validation: Congestive Heart Failure

Evidence related to: PND, Orthopnea and DOE

Dyspnea (SNOMED 267036007) in note on Dec 21, 2017

...sent. She is on PSV of [**5-21**]% however, she may require increased support due to c/o subjective SOB....

Paroxysmal nocturnal dyspnea (SNOMED 55442000) in note on Dec 21, 2017

...n Gtt was stopped. Was kept on PS-5 and Peep-5, 40% with VT's 380-460, O2 sats 96-98%, RR-14-22 ABG PND. L/S clear to crackles @ bases. No swelling noted in mouth or tonque. ETT has + air leak. Swelling ...

Dyspnea (SNOMED 267036007) in note on Dec 23, 2017

...1530: 7.43/56/230. O2 flow turned down from 8L to 6L. LS remain clear. Pt. denies resp. distress or SOB. Sats 98-100%, rr 17-20. CV: HR 100s-120s, AF during and after extubation. Medicated with Lopressor...

Dyspnea (SNOMED 267036007) in note on Dec 31, 2017

...x: F Service: MEDICINE Allergies: Altace Attending:[**First Name3 (LF) 689**] Chief Complaint: shortness of breath, increased angina Major Surgical or Invasive Procedure: central line placement History of Presen...

Dyspnea (SNOMED 267036007) in note on Dec 31, 2017

...she developed URI symptoms including nasal congestion and cough. Since then she has noted increased dyspnea, increased episodes of her anginal pain including at rest and cough productive of yellow/celery col...

Dyspnea (SNOMED 267036007) in note on Dec 31, 2017

...ove, history of CHF, depressed EF, hypertension, afib astham/COPD who presents now with increasing SOB and anginal episodes after URI last Friday. Cardiovascular: a)ischemia: Concerning past history: v...

Evidence related to: Electrocardiogram and Holter Monitor

Nonspecific ST-T abnormality on electrocardiogram (SNOMED 428750005) in note on Dec 17, 2017

...Atrial fibrillation Left axis deviation - left anterior fascicular block Septal and lateral ST-T wave changes - cannot exclude ischemia Since last ECG, T wave inversion in leads I,aVL has pronounced ...

Nonspecific ST-T abnormality on electrocardiogram (SNOMED 428750005) in note on Dec 18, 2017

...Atrial fibrillation Left axis deviation - possible left anterior fascicular block Nonspecific ST-T wave changes Since pervious tracing, no significant change ...

Nonspecific ST-T abnormality on electrocardiogram (SNOMED 428750005) in note on Dec 18, 2017

...Atrial fibrillation Left axis deviation - left anterior fascicular block Nonspecific ST-T wave changes Since pervious tracing, no significant change ...

Electrocardiogram unchanged compared to prior study (SNOMED 142018005) in note on Dec 19, 2017

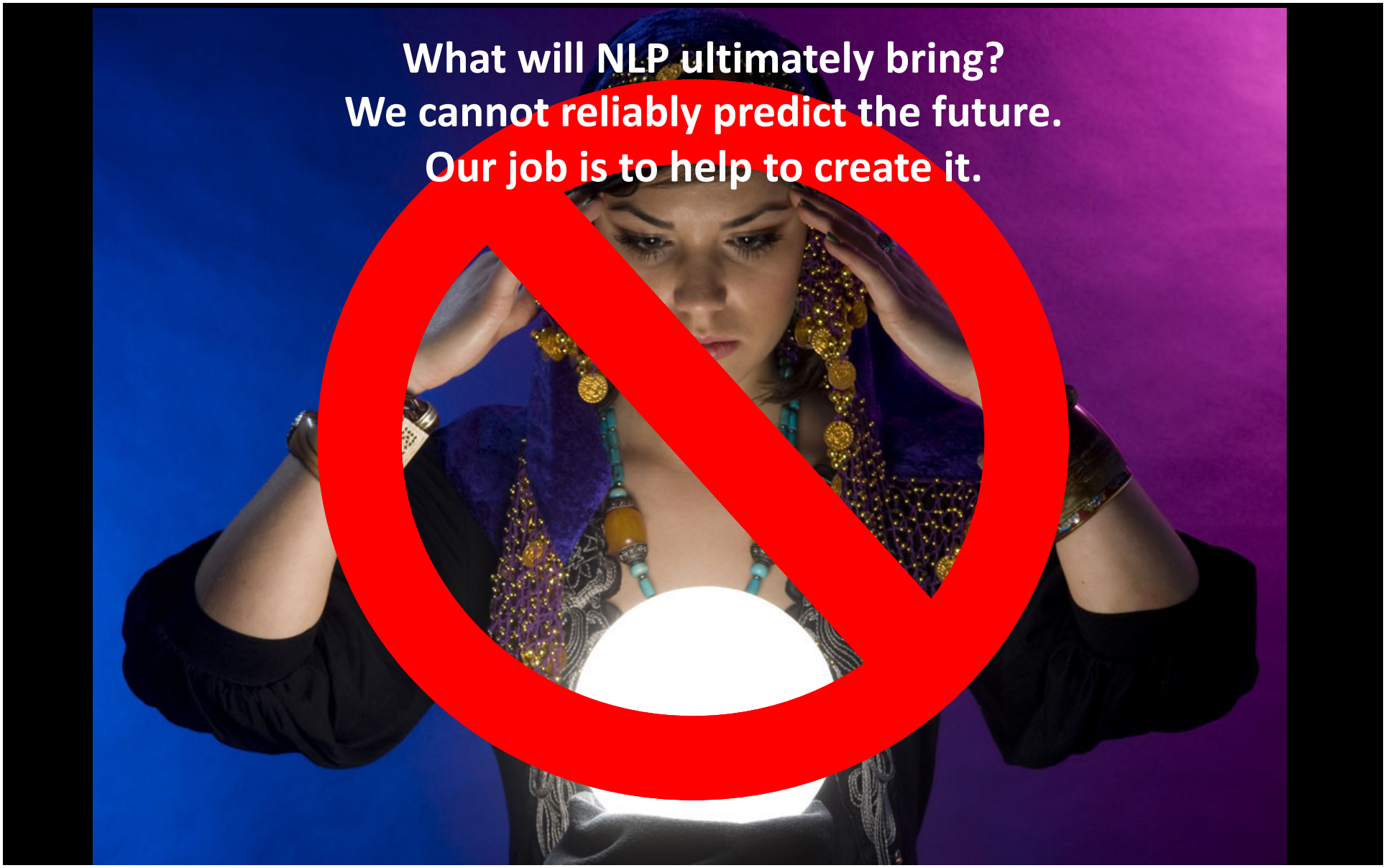
... CV: HR 90-120 NSR/NST. RECEIVED 10MG IV LOPRESSOR W/ LITTLE EFFECT. STABLE BP, HTN WHEN BIPAP OFF. EKG UNCHANGED. RESP: PLACED ON BIPAP ON ARRIVAL W/ PS 10, 5PEEP AND 40% FI02. CONT IN RESP DISTRESS W/ DIFFUSE F...

Nonspecific ST-T abnormality on electrocardiogram (SNOMED 428750005) in note on Dec 28, 2017

...l fibrillation. Left axis deviation - probable left anterior fascicular block. Diffuse non-specific ST-T wave abnormalities. Clinical correlation is suggested. Since the previous tracing of [**2149-12-24**] ventriciular ect...

Topic-Based Navigation: Benefits

- **Clinicians:** True problem-oriented chart review
- **Clinical Documentation Specialists:** Identify query opportunities:
  - ✓ Note Paths that don't include a provider
  - ✓ Path with Note Points in the previous year but not yet this year
  - ✓ Note Points corresponding to a Clinical Indicator in Query Library
  - ✓ Low "Clinical Validation Score" for Principal Diagnosis
- **Revenue Cycle and Denials Management:**
  - ✓ Identify the supporting data needed to challenge denials


What will NLP ultimately bring?
We cannot reliably predict the future.
Our job is to help to create it.

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