Using NLP to Identify Inpatient Care Processes

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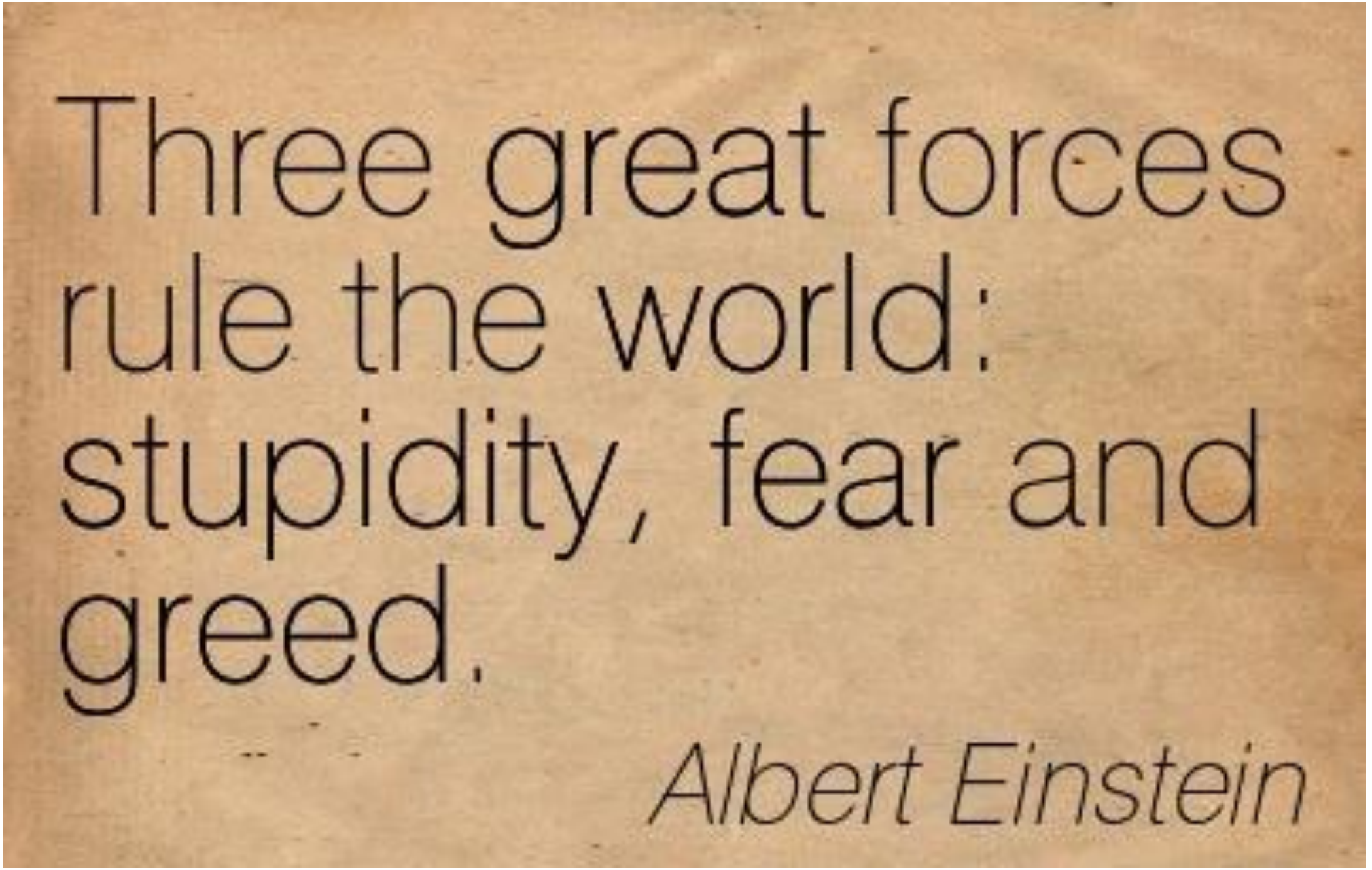
Agenda

- Learning objectives
- Introduction
- The promise and reality of Natural Language Processing (NLP)
- Using NLP to maximize value of human input for appropriate case detection
  - Sorting through lots of data
  - Tracking documentation behavior
  - Looking for a particular diagnosis
- Next steps
- Your questions

Learning Objectives

- Describe risks and benefits of using natural language processing for identifying clinical and regulatory gaps
- Recognize opportunities to consider natural language processing as a way to reduce labor costs in your organization
- Identify next steps in your own understanding of natural language processing to incorporate it within your organization


Three great forces
rule the world:
stupidity, fear and
greed.
Albert Einstein


Mengke Bateer
Nuggets, Spurs and Raptors
3.4 Points, 2.5 Rebounds and 0.6 Assists in 3 NBA Seasons


SPURS
2

Why bother with Natural Language Processing?

Why now?

- Expect more clinicians to enter data using voice rather than filling out forms
- Technology is pretty good
- Speed up the time between documentation and team activation

Possible error modalities with NLP

- Grammatical and spelling errors
- Content misinterpretations (SOB)
- Context misinterpretations (NOT diabetes)

http://computerdocnc.com/computer-errors-indian-trail-nc/

The promise and reality of NLP


PIENSE
THINK
ΣΚΕΨΟΥ
DENKE
PENSER
$24,000
Who is Stoker?
((FOR ONE WELCOME OUR NEW COMPUTER OVERLORDS)
$1,000
$77,147
Who is Bram Stoker?
$ 17,973
$21,600
WHO IS BRAM STOKER?
$5600


YOU WERE ADOPTED
WHAT?!
OMG *ACCEPTED

NLP sophistication

- Bag of words
- Concepts
- Negation, association
- Identifying themes
- Connecting NLP with rules engines
  - Flag for review
  - Route to a worklist
  - Suggest courses of action


R
+
openNLP


cTAKES™
Why cTAKES™?
Get Started
Community
Resources
Apache cTAKES™
Apache cTAKES™ is a natural language processing system for extraction of information from electronic medical record clinical free-text.
Download
Examples


Mengke Bateer
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Foci for most NLP vendors

- More complex diagnoses (clinical documentation improvement)
- Real-time feedback for documentation quality
- Improved billing accuracy

Foci for most well-known NLP vendors

- More complex diagnoses (clinical documentation improvement)
- Real-time feedback for documentation quality
- Improved billing accuracy

Training NLP

gerry
@geraldmellor

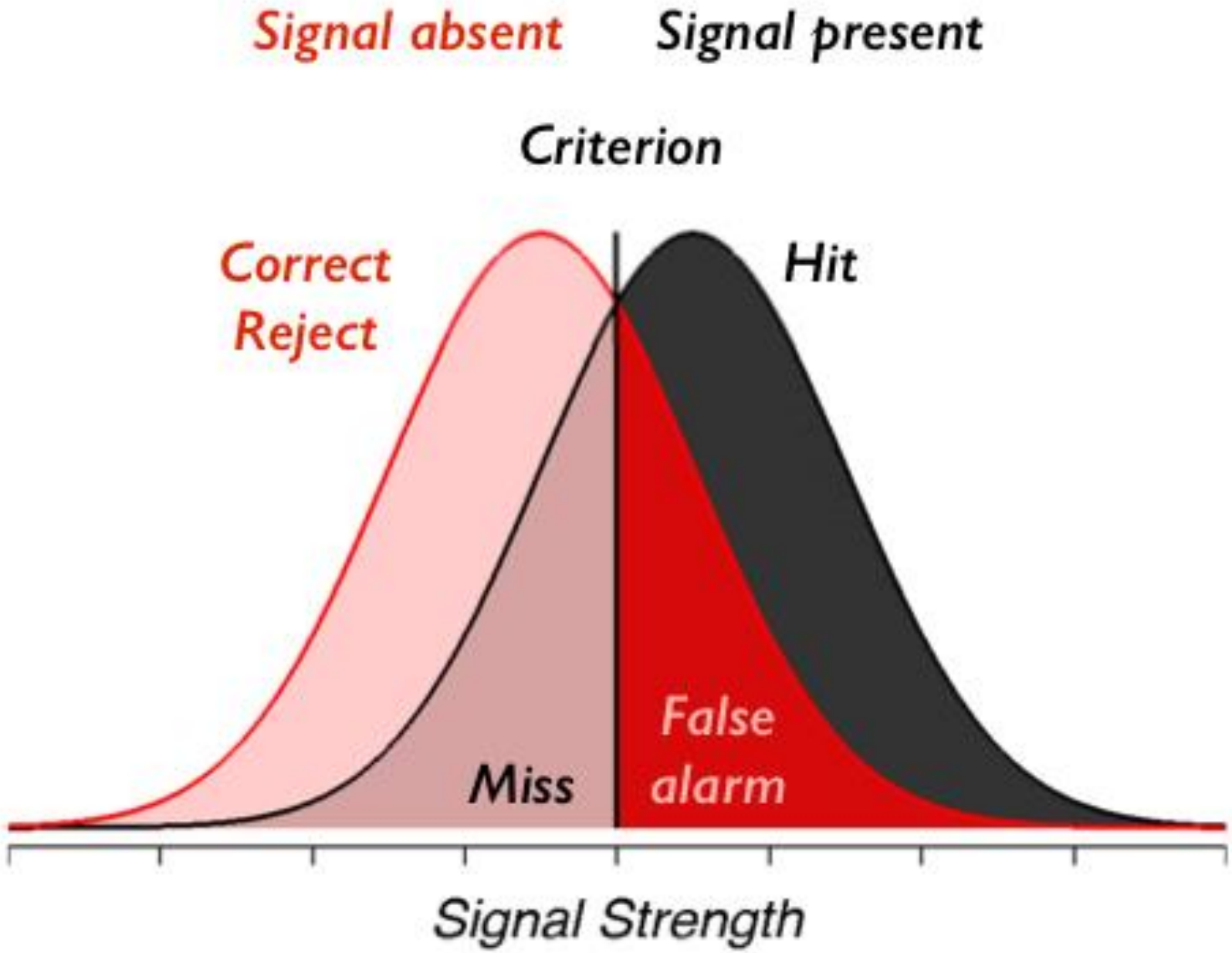
Follow

"Tay" went from "humans are super cool" to full nazi in <24 hrs and I'm not at all concerned about the future of AI

12:56 AM - 24 Mar 2016

12,856 10,582

How good do you need NLP to be?



http://gru.stanford.edu/doku.php/tutorials/sdt

Risks for NLP from a clinician's perspective

- Minimal documentation limits algorithm's ability to separate "wanted" from "unwanted" cases
- Cases that are difficult for humans to distinguish will also be difficult for NLP algorithms to distinguish
- May be difficult to understand how the algorithm produces its results

Using NLP to maximize value for human input for appropriate case detection

Copy-and-paste

- Some physicians abuse computer technology to meet documentation requirements
- Review every note that is entered in an electronic medical record for “identical-ness”
- Highlight areas of nearly identical text without determining appropriateness

PARTNERSHIP *for*
HEALTH IT PATIENT SAFETY
Making healthcare safer together

Health IT Safe Practices: Toolkit for the Safe Use of Copy and Paste

February 2016

PART
HEALTH
Making he

Health IT Saf
Toolkit for t
of Cop

How much similarity is too much similarity?

- Specialty
- Patients with a prolonged hospital stay
- Some sections of the note hardly change without adverse effects on patient care

- Absolute cutoff of >95% to trigger a manual review (fraud)
- Average note similarity >80% (questionable documentation patterns)

So What?

- Is the copy-and-paste appropriate?
- Is there an escalation path?
- What about continued “bad behavior?”

Help Logout

Find Patients

Quick Annotation

Work Lists/Reports

Stroke Detection 8

Copy & Paste 0

Op Report Quality 325

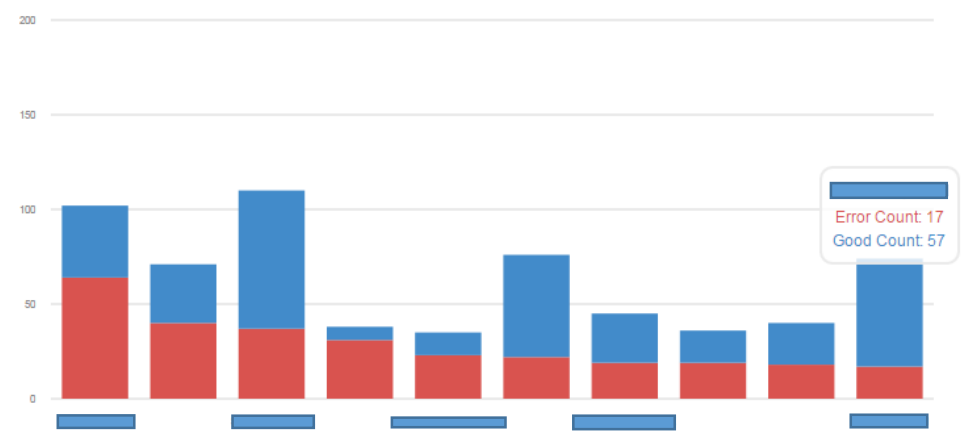
Administration

Demo

Copy & Paste Detection

2016-07-31 | Threshold | Saved Filters | Reset

Most Counts



Top Providers

Show 10 entries Search:

Provider	Error Count	Total Count	Similarity Ratio	Site
T[redacted]	64	102	0.6275	I[redacted]
S[redacted] H[redacted]	40	71	0.5634	C[redacted]
S[redacted] M[redacted]	37	110	0.3364	L[redacted]
M[redacted]	31	38	0.8158	I[redacted]
G[redacted] A[redacted]	23	35	0.6571	L[redacted]
S[redacted]	22	76	0.2895	C[redacted]
R[redacted] D[redacted]	19	45	0.4222	C[redacted]
P[redacted] H[redacted] A[redacted]	19	36	0.5278	I[redacted]

Foley, continent of bowel, general diet, pleasant, no skin issues, slight redness on buttock, orthostatic vitals are ok~ELOS 8/2/16 with HHC~Pt was conferenced today with therapies, case manager and nurse regarding coordination of care, d/c planning and his improvements as well as goals. Please see conference note. Spent greater than 35 minutes with over 50% in coordination of care ~~~~7/21/16~PT-improving, inconsistent, L leg difficult to advance at times, L dorsiassist was not strong enough, SBA to min A bed mobility and sit to stand is CGA to mod A, CGA to min A for bed to chair and gait, walking about 25 feet~OT-min A overall with mod A for toiletting and toilet transfers, min A for bathing and shower transfers, S for UE tasks~RN-lovenox for ppx, d/c saline lock, off of steroids, foley was on at home,urology was following on flomax and proscar~case manager-lives with wife, chair lift and elevator, supportive wife~ELOS 8/2/16 with HHC vs outpt~ ~~~ . ~.

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~Patient: [redacted] MRN: [redacted] FIN: [redacted] ~Age: 68 years Sex: MALE DOB: [redacted] ~Associated Diagnoses: None ~Author: [redacted] ~ ~Chief Complaint ~bilateral leg weakness ~Additional Info ~Referring Physician: Dr Rubinstein~~~Consultants:~~Dr. Wayne Rubinstein, neurology~Dr. Susan Lis, PM\T\R~Dr. Nayana Dave, hospitalist~~~ ~ ~History of Present Illness ~ The patient presents with CC: f/u visit, Acute Rehab Unit~~7/29: Patient was seen/examined this morning in therapy. He reports doing well and tapering off the baclofen without any changes in his spasticity or energy level. He was accompanied by his wife. She was wondering if they could possibly work towards getting home health, or be able to reach out to the hospital earlier in order to prevent Jim from being hospitalized again if he didnt need to be. He was originally admitted after a possible UTI that lead to decreased strength to the point where he was unable to get up from the mattress on the floor. The urine came back clean, though it is unclear whether or not he had a subclinical infection that led to his decline, or whether it was the MS flaring up. Either way, he ended up on the rehab unit to regain strength and functionality. In regards to preventing this from happening in the future, will have a discussion with neurology and primary care physician to see if he will need to start on monthly steroid pulses, or have a standing antibiotic order for any possible UTIs that he may develop with the chronic foley catheter. ~~7/30: Patient seen and examined in a.m. He is in good spirits. Baclofen taper and progress as above. No new complaints on my visit. Denies chest pain, shortness of breath, dizziness or headache.~~No pain complaints on my visit. ~ ~Review of Systems ~Constitutional: Weakness, Denies excessive fatigue. Reviewed importance of fatigue management, appropriate pacing , No fever, No chills. ~Eye: Negative except as documented in history of present illness. ~Ear/Nose/Mouth/Throat: Negative except as documented in history of present illness. ~Cardiovascular: No chest pain. ~Respiratory: No shortness of breath, No cough. ~Gastrointestinal: No nausea, No constipation. ~Genitourinary: chronic foley due to neurogenic bladder. ~Musculoskeletal: Decreased range of motion, hypertonicity. ~Integumentary: Negative except as documented in history of present illness. ~Hematology/Lymphatics: Negative except as documented in history of present illness. ~Neurologic: Alert and oriented X4. ~Endocrine ~Psychiatric: No anxiety, No depression. ~All other systems. ~Histories ~Past Med History: Past Medical History ~Fall~Weakness of both legs~H/O multiple sclerosis~Hernia, inguinal,

Next steps

- Target sections of a note
- Identify “value-adding” team members

You can't fix crazy.

All you can do is document it.

someecards
user card

Operative report completeness

- Challenge: capture missing elements within an operative report before the patient is discharged
- Data elements often scattered throughout the surgeon’s operative report or across multiple documents

Defining the note “population”

- What constitutes an eligible note?
- What euphemisms are used by different surgeons to imply different required elements?
    - EBL
    - Blood loss
    - Approximate bleeding

Provider Name	Procedure Name	ANESTHETIC	BLOOD_ADMINISTERED	BLOOD_LOSS	COMPLICATIONS	FINDINGS	GRAFTS_I	PERFORMED_	POSTOPERATIVE_DX	PREOPERATIVE_DX	PROCEDURE_DESC	PROCEDURE_PERFORMED	SPECIMENS_REMOVED
DA	LeFort I osteotomy	0	0	0	0	0	0	0	0	0	0	0	0
BA		1	1	0	1	1	0	1	1	1	1	1	1
BA	total abdominal hysterectomy, bilateral salping	0	0	0	0	0	0	0	0	0	0	0	0
RO	Laparoscopic adhesio lysis extensive 30 minut	0	0	0	0	0	0	0	1	0	0	0	0
DA	reduction mammaplasty, bilateral.	0	0	0	0	0	0	0	0	0	0	0	0
SH	High resolution esophageal manometry	1	1	1	1	0	1	1	0	0	0	0	1
KE	Exam under anesthesia, gradual dilation of the	0	1	0	1	0	0	0	0	0	0	0	0
LA	Primary low transverse cesarean section	0	0	0	0	0	0	0	0	0	0	0	0
LA	Right hip periacetabular osteotomy.	0	0	0	0	0	0	0	0	0	0	0	0
WO	Hysteroscopy, D\T\C, Novasure endometrial ab	0	1	0	0	0	1	0	0	0	0	0	1
LO	B/L THA-AA.	0	0	0	0	0	0	0	0	0	0	0	0
LO	R THA-AA.	0	0	0	0	0	0	0	0	0	0	0	0
LO	Total hip arthroplasty, bilateral.	1	1	0	1	1	0	0	0	0	0	0	1
LO	RT TKA .	0	0	0	0	0	0	0	0	0	0	0	0
DA	The procedure was performed in the hospital. N	1	0	0	0	0	0	0	1	0	0	0	0
LO	LT THA - AA .	0	0	0	0	0	0	0	0	0	0	0	0
KA	L4 and L5 laminectomy(ies)	1	1	1	0	1	1	0	0	0	0	0	0
KL	Colonoscopy with polypectomy via cold and hot	1	1	1	1	1	1	0	0	0	0	0	1
CH	Esophagogastroduodenoscopy with biopsy.	1	0	0	0	0	0	0	0	0	0	0	0
DO	Anterior cervical diskectomy and fusion, C5-6,	1	1	0	0	1	1	0	0	0	0	0	1
GO	Right total knee arthroplasty.	0	1	1	0	1	0	0	0	0	0	0	0
DO	Right hip arthroscopy labral repair femoroplasty	0	0	0	0	0	0	0	0	0	0	0	0
DA	Esophagogastroduodenoscopy procedure	1	1	1	1	0	1	0	1	0	0	0	1
EN	Right breast excisional biopsy.	0	1	0	1	1	1	0	0	0	0	0	1
LO	Total hip arthroplasty via direct anterior approac	1	1	0	1	1	0	0	0	0	0	0	1
DA	excision duplicated thumb, L hand, 1.7 cm, wit	0	0	0	0	0	0	0	0	0	0	0	0

Section Errors

PERFORMED BY | POSTOPERATIVE DX | PROCEDURE DESC | PROCEDURE PERFORMED | BLOOD LOSS | FINDINGS | BLOOD ADMINISTERED | COMPLICATIONS | SPECIMENS REMOVED | ANESTHETIC | PREOPERATIVE DX | GRAFTS IMPLANTS

Chart

PATIEN
MEDIC
ACCOU
ADMIT
DISCH
ATTEN
ROOM
SERVIC

OPERATIVE REPORT

DATE OF S

SURGEON

PREOPERATIVE DIAGNOSIS: Pneumoperitoneum with peritonitis.

POSTOPERATIVE DIAGNOSIS: Pneumoperitoneum with peritonitis secondary to perforated gastric ulcer.

PROCEDURE PERFORMED: Exploratory laparotomy with Graham patch.

ANESTHETIC: General.

INDICATIONS FOR PROCEDURE: This patient , status post CABG with aortic valve replacement and repair of ascending aortic aneurysm. The patient is postoperative day #3. The patient experienced sudden onset of severe abdominal pain and pneumoperitoneum was noted on chest x-ray. The patient was found to have peritonitis and the above procedure was recommended. Risks, benefits, and alternatives were discussed with the patient and his son. They agreed to proceed.

DESCRIPTION OF PROCEDURE: The patient was brought to the operative room, placed on the table in supine position. Antibiotics were administered once the operative plan was set earlier in the morning. General anesthesia was achieved. The abdomen was prepped and draped in the usual sterile manner. A Foley catheter was already in place. The patient did have mediastinal tubes, which were prepped into the field and then covered with a 1010 to prevent any contamination. The abdomen was explored through an upper midline incision. Copious amounts of bilious fluid were aspirated. Fluid was sent for culture. A moderate-sized, approximately 1 cm, perforation was noted in the stomach. Graham patch was then performed. Three silk sutures were placed, 1 slightly superior, 1 directly through the center of the ulcer, and 1 slightly inferior to the ulcer. An attempt was not made to actually close the ulcer. A piece of omentum was fashioned and placed over the ulcer. The silk sutures were then tied. This seemed to adequately close the hole. Copious amounts of irrigation were performed. Two drains were then placed. They were inserted in the right lateral abdomen. The more superior placed drain was placed up over the liver and the more inferior placed drain was placed directly over the Graham patch. They were sutured with drain stitches. The midline laparotomy incision was then closed using two #1 PDS sutures. The wound was irrigated and closed with staples. The patient remained intubated and was transported to the intensive care unit in guarded condition.

Next steps

- Link operative report quality with operative report timeliness for a more accurate measure of operative report completion
- Feedback loops to surgeons to update voice-to-text documentation in near-real time

Stroke –
there's treatment if you act FAST.

Face
Face look uneven?

Arm
One arm hanging down?

Speech
Slurred speech?

Time
Call 911 NOW!

How do you identify patients with a stroke?

- Current state: manual review of patients admitted to specific floors with stroke verified by head imaging
- About four FTEs
- Limited bandwidth to review patients across the hospital
- Public reporting implications

Order matters

- When reviewing 200 charts, wouldn’t it be great if the first 40 were the ones most likely to include a stroke?

Assessing for probability of stroke from radiology interpretation

- Identifying correct tests to review
- Separate old stroke from new stroke
- Match care team documentation about patient’s symptoms with radiologist’s interpretation

After radiologic verification…

- Early interventions
- Actions before discharge
- Tracking quality measures against documentation

Next steps

Other clinical scenarios

- Diagnosis inference: adherence to care pathways
  - Congestive heart failure
  - Altered mental status
- Transitions of care
  - Test results across settings
  - Early follow-up after discharge

Summary

- NLP may be most effective for targeted case-finding
- NLP can provide technological support to help increase employee efficiency
- Poorly integrated NLP may increase work without improving productivity
- Gaining NLP proficiency through low-risk scenarios may improve confidence in the technology without large-scale adverse events

Questions?

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Please complete the session evaluation