eMERGE pneumonia algorithm v5.1

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Goal: algorithm to identify bacterial pneumonia, similar to that reported with genetic association risk in CD143 and TLR4 A229G in literature.

CASES

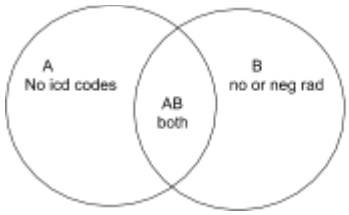
1. Identify all radiology reports with keyword ‘pneumonia’ . Run negation natural language processing (Chapman et al). Lump radiology reports into a 6 month window from first non-negated mention (this is index time zero), 1 month prior and 5 months after (see Figure 1.) Report in PNA_Data_Dictionary_1:
    a. All ‘Radiology PNA event’ per subject.
    b. Per ‘Radiology PNA event’, report number of negated and non-negated imaging reports
2. Around each ‘Radiology PNA event’, report a 31 day prior and 31 day following window to identify at least 2 mentions of ICD9/10 codes from Appendix A. Report count of each codes per subject on unique days in window in PNA_Data_Dictionary_2.
3. Around each ‘Radiology PNA event’, look for antibiotic therapy with same 31 day prior and 31 day following window to identify at least 1 mention of antibiotic treatment listed in Appendix B. Report count of antibiotic mentions on unique days in window in PNA_Data_Dictionary_3.
4. The combination of these three criteria can be uses to review cases for sensitivity and specificity- validation site confirmed using non negated radiology reports and ICD codes only, not the antibiotic information, had sufficient specificity and better sensitivity. The antibiotic information is still requested in case used as covariate.
5. Remove cases with two instances of exclusion codes in Appendix C- two of same code or two from same bin, occurring in time frames A or B as below per ‘Radiology PNA event’. Record exclusions by bin in PNA_Data_Dictionary_4.
6. Report covariates in PNA_Data_Dictionary_1:
    a. By Subject:
        i. Gender
        ii. Race
        iii. Ethnicity
    b. By ‘Radiology PNA event’, as close as available to index time zero:
        i. Non pregnant BMI closest to event
        ii. Non pregnant BMI averaged in adult life
        iii. Admitted? y/n
        iv. Day of hospitalization (if known)
        v. Length of hospitalization (if known)

CONTROLS

1. Include any subjects to those who meet the medical home definition 3 or more primary care visits in 2 years (from published eMERGE BPH algorithm).
2. Exclude any subjects with two occurrences of any code from a bin in Appendix C on unique dates. (ex. Two from heart failure on different dates exclude, one from heart failure and one from malignancy do not exclude (different categories)). Complete PNA_Data_Dictionary_4.csv for control counts excluded by bin.

3. Identify:
    a. Subjects without any single mention of any pneumonia code (Appendix A)
    b. Subjects with no positive reports (can have negated only or none).
4. Report covariates in PNA_Data_Dictionary_1:
    a. By Subject:
        i. Year of birth
        ii. Gender
        iii. Race
        iv. Ethnicity
        v. Non pregnant BMI averaged in adult life

Venn diagram of potential controls:



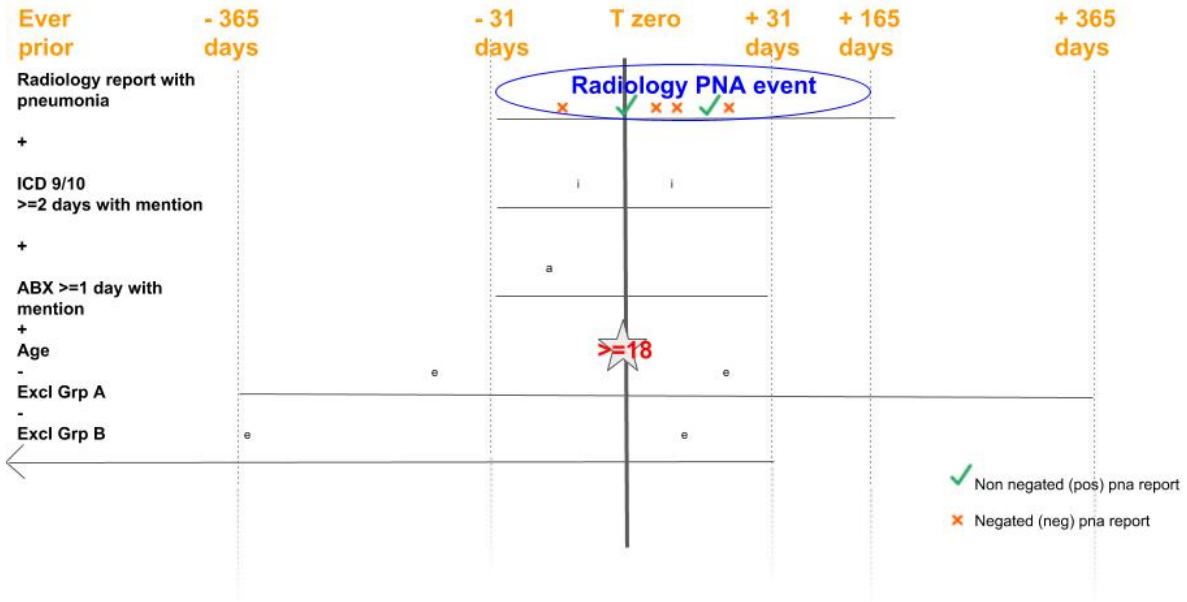
* Possibly in future hospitalization epochs for occurence while inpatient or outpatient though not included in current data dictionary.

EXCLUSIONS

Exclusions	**timing**	**bin**
age	< 18 at time radiology pneumonia event	
Group A	>= 2 occurrences of code on different dates one year before or one year after radiology PNA event	Pregnancy Addiction Alcoholism Decomp DM Decomp HF Fungal pneumonia Viral pneumonia
Group B	>= 2 occurrences of code on different dates anytime before or up to one year after radiology PNA event	AIDS Immunodeficiency Asthma COPD Tuberculosis Malignancy Lung transplant

See excel file PNAexclusions.csv for codes to each group on phekb (Appendix C).

Figure 1: Graphic of pneumonia event.



Appendix A: ICD9 and ICD10 codes for inclusion

See excel file PNAinclusions.csv for codes to each group on phekb.

Appendix B: Antibiotics

See file: PNAabxcuis.csv on phekb for CUI codes matching list.

abelcet	**cefazolin**	**CLAVULANATE (AUGMENTIN)**
ADOXA	**CEFAZOLIN / CLINDAMYCIN**	**cleocin**
ALTABAX	**cefdinir**	**cleocin t**
amikacin	**CEFDINIR : OMNICEF**	**clindamycin**
amikin	**cefepime**	**clindamycin : cleocin**
amox	**cefepime / flagyl**	**clindamycin hcl**
amoxicillin	**cefixime**	**CLINDAMYCIN HCL (CLEOCIN)**
amoxicillin-clavulanate	**CEFOTAN**	**CLINDAMYCIN PHOSPHATE**

amoxil	cefotaxime	colistimethate
amphotericin	cefotetan	colistin
amphotericin b	cefoxitin	cosmegen
amphotericin b lipid complex	cefpodoxime	COTRIMOXAZOLE
ampicillin	CEFPROZIL	cubicin
AMPICILLIN / MEROPENEM	ceftazidime	daptomycin
AMPICILLIN SODIUM	ceftin	daunorubicin
ampicillin-sulbactam	ceftriaxone	dicloxacillin
ancef	ceftriaxone w/lidocaine	DORYX
antispasmodics	cefuroxime	doxycycline
atropine	cefuroxime : ceftin	doxycycline : vibramycin
atropine sulfate	cefuroxime axetil	doxycycline hyclate
augmentin	cefuroxime axetil (ceftin)	DOXYCYCLINE MONOHYDRATE (MONODOX)
AVALOX	cefzil	DOXYCYLINE
avelox	cephalexin	e-mycin
azactam	CEPHALEXIN (KEFLEX)	ees
azithromycin	CEPHALEXIN HCL	ertapenem
azithromycin : zithromax	CEPHALOTHIN	ERYTHROCIN
aztreonam	chloramphenicol	erythromycin
bactrim	CILOXAN	erythromycin base
BACTRIM (SMZ-TMP)	cipro	ERYTHROMYCIN ETHYLSUCCINATE
BACTRIM / VALCYTE	cipro / flagyl	ERYTHROMYCIN LACTOBIONATE
bactrim ds	CIPRO / LEVOFLOXACIN	erythromycin stearate
BACTRIM DS (TMP-SMX)	cipro hc	flagyl
bactrim single strength	CIPRO XR	flagyl (metronidazole)
bactrim ss	ciprodex	FLAGYL / CEFEPIME
biaxin	CIPROFLAXACIN	floxacillin
BIAXIN / PENICILLIN	ciprofloxacin	floxin

BIAXIN XL	ciprofloxacin : cipro	FLOXIN OTIC
BICILLIN	CIPROFLOXACIN (CIPRO)	fortaz
blenoxane	ciprofloxacin ophthalmic	garamycin
bleomycin	CIPROFLOXIN	GRIFULVIN V
ceclor	claforan	GRISEOFULVIN
cedax	clarithromycin	griseofulvin microsize
cefaclor	CLARITHROMYCIN (GENERIC)	idamycin
CEFADROXIL	CLARITHROMYCIN / AMIKACIN	ILOTYCIN
imipenem / cilastatin	clavulanate	imipenem
imipenem-cilastatin	MINOCYCLINE HCL	suprax
imipenem-cilastatin injection	MITOMYCIN	SYNERCID
INJECTABLE	MONARCH	tcn
INJECTABLES	moxifloxacin	tequin
INJECTABLES	nafcillin	TERRAMYCIN
invanz	nebcin	tetracycline
isoniazid	nitrofurantoin	ticar
isoniazid : nydrazid	NITROFURANTOIN : FURANTOIN	ticarcillin
isoniazide	nitrofurantoin macrocrystal	ticarcillin / clavulanate
keflex	NITROFURANTOIN MACROCRYSTALS	tigecycline
kefzol	nitrofurantoin monohydrate	timentin
KETEK	ofloxacin	TOBRAMYCIN SULFATE
L-ARGININE	omnicef	trimethoprim
l-arginine powder	oxacillin	trimethoprim / sulfamethoxazole
l-hyoscyamine	pen vk	trimethoprim-sulfamethoxazole
l-hyoscyamine : levsin	PEN-VEE K	trimox / amox
levaquin	PEN-VK	trimpex
levaquin / flagyl	penciclovir	tromethamine
levaquin / ibuprofen	penicillin	TROVAFLOXACIN

levaquin leva-pak	PENICILLIN G	TROVAN
levofloxacin	PENICILLIN G BENZATHINE	ULTRACEF
levofloxacin : levaquin	PENICILLIN G POTASSIUM	unasyn
LORABID	penicillin v potassium	vanc
mafenide	penicillins	vanc / cefepime
mafenide acetate	pentostatin	VANC / DORIPENEM
MAFENIDE HCL	phenazopyridine	vanc / rocephin
maxipime	phenazopyridine : pyridium	vanc / zosyn
MAXITROL	piperacillin	VANCENASE
MAXITROL	piperacillin / tazobactam	vancenase aq
MEFOXIN	piperacillin-tazobactam	VANCERIL
MERONEM	piperacillin-tazobactam inj	vancocin
meropenem	primaxin	vancomycin
MEROPENEM : MERREM	pyrazinamide	vancomycin : vancocin
merrem	QUIXIN	VANCOMYCIN / CEFOTAXIME
methicillin	rifampin	vancomycin / doripenem
metronidazole	rifampin : rifadin	vancomycin / ertapenem
metronidazole : flagyl	rocephin	VANCOMYCIN WITH GENTAMICIN
METRONIDAZOLE (FLAGYL)	septa	vantin
METRONIDAZOLE (NYDAMAX)	septra	VIBRAMYCIN
METRONIDAZOLE VAGINAL	septra ds	VIGAMOX
MINOCIN	streptomycin	ZARTAN
MINOCIN (MINOCYCLINE HCL)	STREPTOZOCIN	zinacef
minocycline	sulfamethoxazole-trimethoprim	zithromax
minocycline : minocin	sulfamylon	ZITHROMAX (ZPAK)
zithromax z-pak	sulfamylon (mafenide)	zithromax / rocephin
zosyn	zosyn / cipro	zosyn / nsaids
ZPACK	zpak	

Appendix C: Codes for exclusion

See excel file PNAexclusions.csv for codes to each group on phekb

References

Chapman, W. W., et al. (2001). "A Simple Algorithm for Identifying Negated Findings and Diseases in Discharge Summaries." Journal of Biomedical Informatics 34(5): 301-310.

REVIEW FORMS

Cases

1	2	3	4	5	6	7
Subj/T0	**Radiology**	**ICD 9/10**	**Antibx**	**Agree/dis**	**Explain disagrees**	**Any copy/ paste info**

1. From Data dictionary- take cases that have two case criteria met:
    a. Non negated radiology report, AND
    b. 2 ICD9 mentions in window

   And go to Tzero of pneumonia event.
2. Read radiology report
    a. Agree this is a non-negated pneumonia report- 1; disagree- 0.
3. Look for billing code in the window as shown in data dictionary.
    a. Agree- 1; disagree- 0.
4. Optional- Look for antibiotics in the window as shown in data dictionary. (optional- antibiotics not in final validated algorithm).
    a. Agree- 1; disagree- 0.
5. Check if 2 (Radiology) and 3 (ICD) agree
    a. Agree- 1; disagree- 0.
6. If 5 is disagree/0, write a few sentences about why, where information found.
7. Available for copy and paste information related to 6.

Controls

1	2	3	4	5	6	7	8	9	10
Subj	**Keyword**	**Kw PNA dx?**	**Radiology**	**Rad PNA dx?**	**ICD9/10**	**Abx**	**Agree/dis**	**Explain disagrees**	**Any copy/paste info**

1. Identifier
2. Search record for keyword ‘pneumonia’.
    a. Present-1; not present- 0.
3. If 1 is Present, patient has pneumonia?
    a. Yes- 1; no- 0.
4. Search radiology reports for ‘pneumonia’
    a. Present- 1; not present- 0
5. If 3 is Present, did patient have pneumonia?
    a. Yes- 1; no- 0.
6. Search ICD9 codes for ‘pneumonia’ within window
    a. Present >= 2x- 1; not present or < 2x- 0.
7. If Rad and ICD9 are positive, look for antibiotics in window.
    a. Present- 1; not present- 0, or NA.
8. Overall agree/disagree
    a. Disagree this subject is not a control, has evidence of pneumonia- 1; Agree this a control with NO evidence of pneumonia- 0
9. If 8 is Disagree/1- any control appears to have pneumonia, write a few sentences about why, where information found
10. Available for copy/paste information related to 9