Using Machine Learning on ICD-10 data to Enhance an Expert Anaphylaxis Case Definition

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Identification of treatment related adverse events (AEs) is **critical** to FDA's **surveillance** activities.

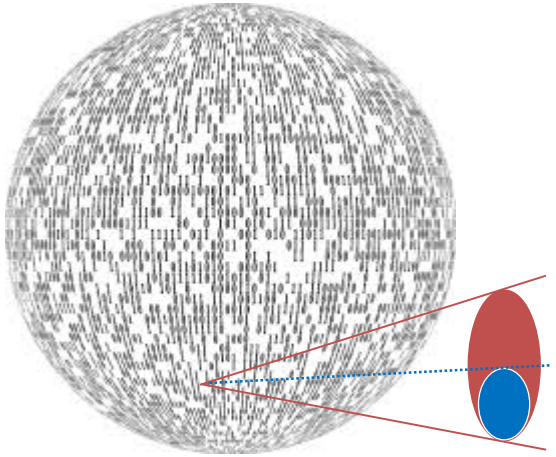
Case definitions are necessary to identify specific episodes that are potentially AEs from large collections of health care data.

Problem:
Case definitions are time consuming and difficult to construct from administrative data.

Objective:
Use **machine learning** to enhance a human constructed case definition for detection of true cases of incident **anaphylaxis** in the CMS database.

CMS episodes

*Medicare has data from health care encounters for **60 million Americans** per year*



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
1	Class Label	Index	Ind	Ind	Inde	Inde	Ind	Inde	Inde	Ind	Ind	Ind	Inde	Inde	Ind	Inde	Inde	Inde	Inde	Ind	Ind	Inde	Inde	Inde	Inde	Inde	Index	Inde	Inde	Inde	Inde	Inde	Inde	Index	Allergy	Aller	Aller	Aller	Allerg	Allerg	All
2			Episode ID																																						
3			1	7	11	18	20	28	36	37	41	47	53	55	64	67	69	71	73	88	89	94	96	98	100	101	103	106	107	110	111	115	119	121	124	130	135	143	146	150	154	156
4	ER	1	0	1	1	1	1	1	1	1	0	0	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	0	1
5	Subsequent hospital care		1	5	28	5	1		1	4	1	1	13	3			4	2	2			5	4						1	2	2			4	1	1	1		7	1		
6	Critical care, first hour		2	3	9	3			1	2	1	2	3	2			4	1	1			5		2		1	3		2			1	5					2	1	3	1	1
7	TOTAL CHARGE	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	PHARMACY (ALSO SEE 063X, AN EXTENSION OF 025X) - GEN	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1		1	1		1	1
9	LABORATORY - GENERAL CLASSIFICATION	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1		1					1	1		1	1			1	1	1	1	1	1	1	
10	LABORATORY - CHEMISTRY	1		1		2		1	1	1	1		1		1	1	1	1		1	1	1	1	1	1	1	1	1	1		1		1	1	1	1		1	1	1	1	1
11	EKG/ECG (ELECTROCARDIOGRAM) - GENERAL CLASSIFICATIC	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1
12	Anaphylactic shock, unspecified, initial encounter		2	2	1	4	3		4	7		2	4				8	1		6			2	1			1	2	2				9				2		3	2	1	
13	LABORATORY - HEMATOLOGY	1		1		2		1	1	1	1		1		1	1	1	1		1	1	1	1	1	1	1	1	1	1		1		1		1	1		1	1	1	1	1
14	RESPIRATORY SERVICES - GENERAL CLASSIFICATION	1	1	1	1	2	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1		1	1		1	1	1
15	EMERGENCY ROOM - GENERAL CLASSIFICATION	1		1	1	2	1	1	1	1			1	1			1	1	1	1			1	1	1	1	1	1			1	1		1	1	1	1	1	1	1		1
16	Angioneurotic edema, initial encounter			2	12		1							6					5									4					1	1			1		4			
17	Anaphyl reaction due to advrs eff drug/med prop admin, ir	2		1	1	2		1		1	1		1	1	1	1	1	6	3	1	1	1	1	1	1	1			3	4	1	2	1	1			1		1	1	1
18	RADIOLOGY - DIAGNOSTIC - CHEST X-RAY	1		1	1	2		1	1	1				1	1		1	1	1		1	1	1	1		1	1	1				1		1	1	1	1		1	1	1	1
19	MEDICAL/SURGICAL SUPPLIES AND DEVICES (ALSO SEE 062X	1			1	1		1	1	1	1		1	1	1		1				1	1	1		1	1	1						1				1	1	1		
20	LABORATORY - BACTERIOLOGY & MICROBIOLOGY	1		1		2		1		1			1		1	1	1				1	1	1	1	1	1	1	1	1		1		1			1	1	1	1	1	1	1
21	Initial hospital care				1	1	2		2				2	1					1				1						1	1			1	1	1		1	1	3	3		
22	MEDICAL/SURGICAL SUPPLIES AND DEVICES (ALSO SEE 062X, AN EXTEN		1		1						1		1	1			1	1	1			1	1	1		1	1			1								1				1
23	Essential (primary) hypertension				1	1			1	1			2	2	1					1	2	1	1		1			3		3	1					1	1	3	5			
24	PHARMACY (ALSO SEE 063X, AN EXTENSION OF 025X) - IV SOLUTIO		1		1				1	1		1		1				1		1		1		1				1					1	1					1			1
25	Acute respiratory failure with hypoxia	2	4	3		1			1	3	1	4		5		1	1	6		2		3		1	1			1	1	1			3	4						5		1
26	Insertion of Endotracheal Airway into Trachea, Via Opening	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1
27	RADIOLOGY - DIAGNOSTIC - GENERAL CLASSIFICATION	1	1		1		1	1	1	1	1	1	1		1	1	1	1	1	1		1		1	1	1			1	1		1		1				1	1			
28	INTENSIVE CARE UNIT - GENERAL CLASSIFICATION		1		1	1	1	1	1	1		1		1		1	1	1		1				1			1		1	1								1	1		
29	Insert emergency airway	1			1	3			1	1				1		1				1			1	1	1		2	1		1				1				2	1	1		1
30	PHYSICAL THERAPY - GENERAL CLASSIFICATION			1					1	1	1		1	1	1	1	1		1	1	1	1	1	1				1		1		1	1	1	1	1						1
31	PULMONARY FUNCTION - GENERAL CLASSIFICATION	1		1		1		1			1			1	1		1	1	1		1	1			1		1	1			1		1	1	1	1				1		1
32	Acute respiratory failure, unsp w hypoxia or hypercapnia	1			39	3		1	1	2									3					1	1			5		1		1	2	6					1	5	3		
33	PHYSICAL THERAPY - EVALUATION OR RE-EVALUATION			1		1			1					1	1	1	1			1	1	1	1		1	1		1		1		1	1	1	1	1						
34	LABORATORY - UROLOGY	1		1		2			1				1				1			1	1	1		1	1			1	1				1		1			1	1	1		
35	Hospital discharge day					1				1			1				1										1		1				1		1				1			
36	Electrocardiogram report	1	1		1	1			1			1						4	2	2					1			3			2							1	1			
37	LABORATORY - IMMUNOLOGY	1							1	1	1		1			1				1		1		1	1	1		1				1			1			1	1	1		1
38	Respiratory Ventilation, 24-96 Consecutive Hours		1	1			1		1	1		1	1	1	1		1	1	1			1		1	1	1	1		1			1		1				1	1			
39	Acute kidney failure, unspecified		1									1	7				1	1		2				2	1			3	1	1					1	1		1		4	1		
40	OPERATING ROOM SERVICES - GENERAL CLASSIFICATION				1			1	1	1	1				1						1					1											1				
41	Athscl heart disease of native coronary artery w/o ang pctrs				1			1	2		1			1									1						2									1				

We suggest a novel way of using machine learning to **help create case definitions**

and

we apply it to identify cases of **anaphylaxis**, a serious, life-threatening allergic reaction.

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