New Tactics for Old Problems

3:15PM EST | November 18th, 2020 | 2020 SyS Symposium

Moderated by Harold Gil, MSPH – Washington State Department of Health

Speakers:

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Viacony Herzi, MPH, MLS(ASCP)CM – Maricopa County Department of Public Health (Arizona) +

Sasha Harb, MPH – Pima County Health Department (Arizona)

PJ Gibson, BS – Indiana Department of Health

National Syndromic Surveillance Program
Community of Practice
Advancing the Science and Practice of Syndromic Surveillance

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Council of State and Territorial Epidemiologists

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Comparison of matched emergency department and inpatient hospital visits attributable to nonfatal opioid overdoses between hospital discharge and NSSP BioSense data ---Maricopa and Pima Counties, Arizona, 2018.

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Project Objectives

1

Understand how Hospital Discharge and Syndromic Surveillance data compare to each other

2

Understand how health conditions such as nonfatal opioid overdoses are classified in each system

3

Provide a standardized protocol for how to match the data and do health condition comparisons.

Background: Surveillance Systems for Opioid Overdose

Hospital Discharge Data (HDD)

- Bi-annual data distribution
- Administrative data
- ICD-10-CM diagnosis codes
- Valuable source about the patterns of care, public health, and the burden of chronic disease and injury morbidity

Syndromic Surveillance (NSSP ESSENCE)

- At minimum daily data
- Subset of hospitals who participate
- ICD 10 diagnosis codes & text
- Valuable data for an early alert for health events
- Syndrome categories that define health conditions (i.e. Chief Complaint and Discharge Diagnosis combinations)

Background: Maricopa County and Pima County (Arizona)

Large population and syndromic surveillance representation

- Maricopa County (MC) in 2018
  - Population: 4,294,460
  - 11 hospitals in ESSENCE/73 total hospitals
- Pima County (PC) in 2018
  - Population: 1,034,201
  - 5 hospitals in ESSENCE/17 total hospitals

METHODS: Matching

Match emergency department and inpatient hospital visit data from HDD and ESSENCE on unique patient-level variables

- MC: Facility Identifier and Patient Control Number (PCN)/Visit ID
- PC: Facility Identifier and Medical Records Number in combination with PCN, Discharge date and Admission date

METHODS: Classifying

Classify records according to definitions:

- HDD
  - CSTE Nonfatal Overdose Definition
- ESSENCE
  - CCDDcat: CDC Opioid Overdose v2, no changes
  - ICDonly: CDC Opioid Overdose v2, ICD codes only
  - CCDDext: CDC Opioid Overdose v2, applied to additional fields

METHODS: Classifying

Assess the extent of agreement between records identified in HDD and ESSENCE

- HDD as the "gold standard."

	Case Definition Category 1	Case Definition Category 2	Case Definition Category 3
HDD	Nonfatal Opioid Overdoses	Nonfatal Opioid Overdoses	Nonfatal Opioid Overdoses
ESSENCE	CCDDcat	ICDonly	CCDDext

Examine visits where there was disagreement in classification

RESULTS: Matching

County	Total Visits	Matched Visits	Percent of Visits Matched (2018)
MC	835,035	823,127	98.6%
PC	348,251	333,625	95.8%

RESULTS: Classification

Among matched records, most ESSENCE queries classified more visits as a nonfatal opioid overdose than the HDD case definition in both counties.

	Case Definition Category 1 (HDD ~ CCDDcat)		Case Definition Category 2 (HDD ~ ICDonly)		Case Definition Category 3 (HDD ~ CCDDext)	
County	*MC*	*PC*	*MC*	*PC*	*MC*	*PC*
HDD	1,662	745	1,662	745	1,662	745
ESSENCE	2,972	1,462	1,196	609	2,994	1,462
% Agreement	99.8%	99.7%	99.9%	99.9%	99.8%	99.7%

RESULTS:
Classification by ESSENCE Query

Maricopa County		CCDDcat		ICDonly		CCDDext	
		Yes	*No*	*Yes*	*No*	*Yes*	*No*
HDD	*Yes*	1,326	336	1,127	535	1,340	322
	No	1,646	819,819	69	821,396	1,654	819,811
		% Agreement:	99.8%		99.9%		99.8%

Pima County		CCDDcat		ICDonly		CCDDext	
		Yes	*No*	*Yes*	*No*	*Yes*	*No*
HDD	*Yes*	589	157	545	201	589	157
	No	875	332,004	66	332,813	875	332,004
		% Agreement:	99.7%		99.9%		99.7%

RESULTS:
Why in ESSENCE but not HDD?

Referent diagnosis codes (ICD-10-CM)	Maricopa County (N = 1646)		Pima County (N = 875)	
	HDD	ESSENCE	HDD	ESSENCE
Opioid-related disorders (ORD) F-codes (F11.1-F11.9)	511*	34*	378*	28*
Opioid intoxication or overdose T-codes (T40.0X-T40.4x, T40.60, and T40.69)	56**	0	24**	0
Drug use, abuse, dependence F-codes (F12-F16, F18-F19)	245	0	84	0
Drug-poisoning T-codes (T36-T50)	142	0	87	0
No drug-related T-codes or F-codes	754	0	214	0

*F11 is not included in the CSTE case definition for acute opioid overdose identification

**Records with opioid overdose T-codes but not included in CSTE HDD case definition (ex T40605A)

- Records that do not have any drug-related T-codes and F-codes in any diagnosis field were likely identified in ESSENCE through terms like Narcan in the CCDD field.

RESULTS:
Why in HDD but not ESSENCE?

Referent diagnosis codes (ICD-10-CM)	Maricopa County (N = 336*)		Pima County (N = 157)	
	HDD	ESSENCE	HDD	ESSENCE
Opioid-related disorders (ORD) F-codes (F11.1-F11.9)	78	2	34	3
Opioid intoxication or overdose T-codes (T40.0X-T40.4x, T40.60, and T40.69)	336*	335	157*	157

*These records have opioid overdose T-codes that are included in the syndrome definitions such as T402X2A.

Conclusions

A high percentage (98.6%, MC; 95.8% PC) of the HDD and ESSENCE visits matched for Maricopa and Pima Counties.

This suggests that data collected in both systems have primarily the same records

However, there are variations of how nonfatal opioid overdoses are identified in each

These variations need to be considered before these two databases are combined.

Limitations

Opioid overdose definition changes

Hospital participation in ESSENCE may vary by jurisdiction

HDD is an administrative billing data set

Variability of hospital data in ESSENCE

Admission and discharge record differences between databases

Next Steps

1. Dissemination of standardized protocol for other AZ counties
   - Toolkit
     - Step by Step instructions
     - SAS program
     - Reference documents
     - Data dictionaries for both databases
     - Evaluation guide
2. Share with CSTE work groups such CSTE Injury Surveillance Workgroup to further study and may be improve case definition
3. Use the standardized protocol and toolkit to improve utilization of both HDD and ESSENCE for opioid overdose surveillance

Acknowledgements & Disclosure

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Disclosure: The contents of the presentation are solely the responsibility of the authors and do not reflect the official views of the US Department of Health and Human Services or the Centers for Disease Control and Prevention

Thank You!

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ADTdq

- a python library for HL7 ADT data quality reporting

PJ Gibson

Syndromic Data Analyst

The Problem

MSH|^~\&|EPICADT|DH|LABADT|DH|201301011226||ADT^A01|HL7MSG00001|P|2.3|

EVN|A01|201301011223||

PID|||MRN12345^5^M11||APPLESEED^JOHN^A^III||19710101|M||C|1 DATICA STREET^^MADISON^WI^53005-1020|GL|(414)379-1212|(414)271-3434||S||MRN12345001^2^M10|123456789|987654^NC|

NK1|1|APPLESEED^BARBARA^J|WIFE|||||NK^NEXT OF KIN

PV1|1|I|2000^2012^01||||004777^GOOD^SIDNEY^J.|||SUR||||ADM|A0|

*example HL7 ADT message, NOT real

- Difficult to read/parse
- High complexity -> hard to assess for DQ

A Solution

- Use NSSP Standards (Data Dictionary)
  - Parse HL7 ADT messages for high-priority elements
  - Assess messages for element completion & validity

HL7 Archive Processed Name	HL7 Archive Processing Description	Processing Rationale	Column Length	Repeating field	Priority
Chief_Complaint_Text	OBX-5 segments where: * OBX-3 Observation Identifier is 8661-1 and/or 11292-0 * OBX-2 = "TX" or "CWE" or "CW" Select all non-null values and concatenate: IF OBX-2="TX" then Chief_Complaint_Text = OBX-5.1 IF OBX-2="CWE" or "CW" then Chief_Complaint_Text = concatenate(OBX-5.9, OBX-5.2, OBX-5.5)	The CWE Chief Complaint type is a legacy format of Chief Complaint. It is being included to capture legacy data feeds. The TX Chief Complaint is from PHIN Messaging Guide for Syndromic Surveillance, Release 2.0 (April 2015).	varchar(3000)	Yes	1

My Work

1. Created a function to parse HL7 messages for NSSP Priority Elements
2. Created supporting functions for
    a) Data Visualization
    b) Data Reporting
3. Packaged functions for others to use

(Catered to low-experience Python programmers)

1 NSSP_Element_Grabber

- Reads messages & parses them into neat data-frame
- ~550 messages parsed per minute

	Age_Reported	C_Patient_County	Age_Units_Reported	Race_Code	Ethnicity_Code	Ethnicity_Description	Patient_City
0	43	1793	YEAR	2131-1	2186-5	NON-HISPANIC	Naptown
1	5	1746	YEAR	2131-1	2186-5	NON-HISPANIC	Naptown
2	64	1826	NaN	2106-3	N	NaN	Naptown
3	74	1843	YEAR	2106-3	2186-5	Not Hispanic or Latino	Naptown
4	98	1791	YEAR	2106-3	2186-5	Not Hispanic or Latino	Naptown
...	...	...	...	...	...	...	...
9387	25	1753	NaN	2054-5	N	NaN	Naptown
9388	35	1853	YEAR	2131-1	2135-2	Hispanic or Latino	Naptown
9389	91	1734	YEAR	2054-5	2186-5	Not Hispanic or Latino	Naptown
9390	19	1788	YEAR	2054-5	2186-5	Not Hispanic or Latino	Naptown
9391	16	1548	YEAR	2131-1	2135-2	Hispanic or Latino	Naptown

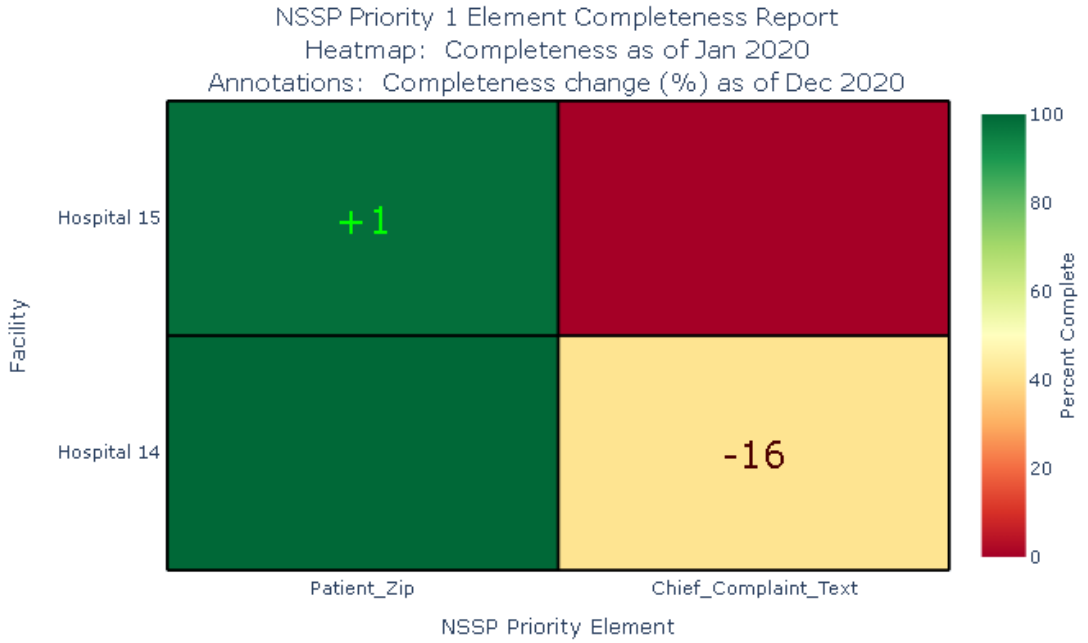
*Records NOT real, randomized using examples

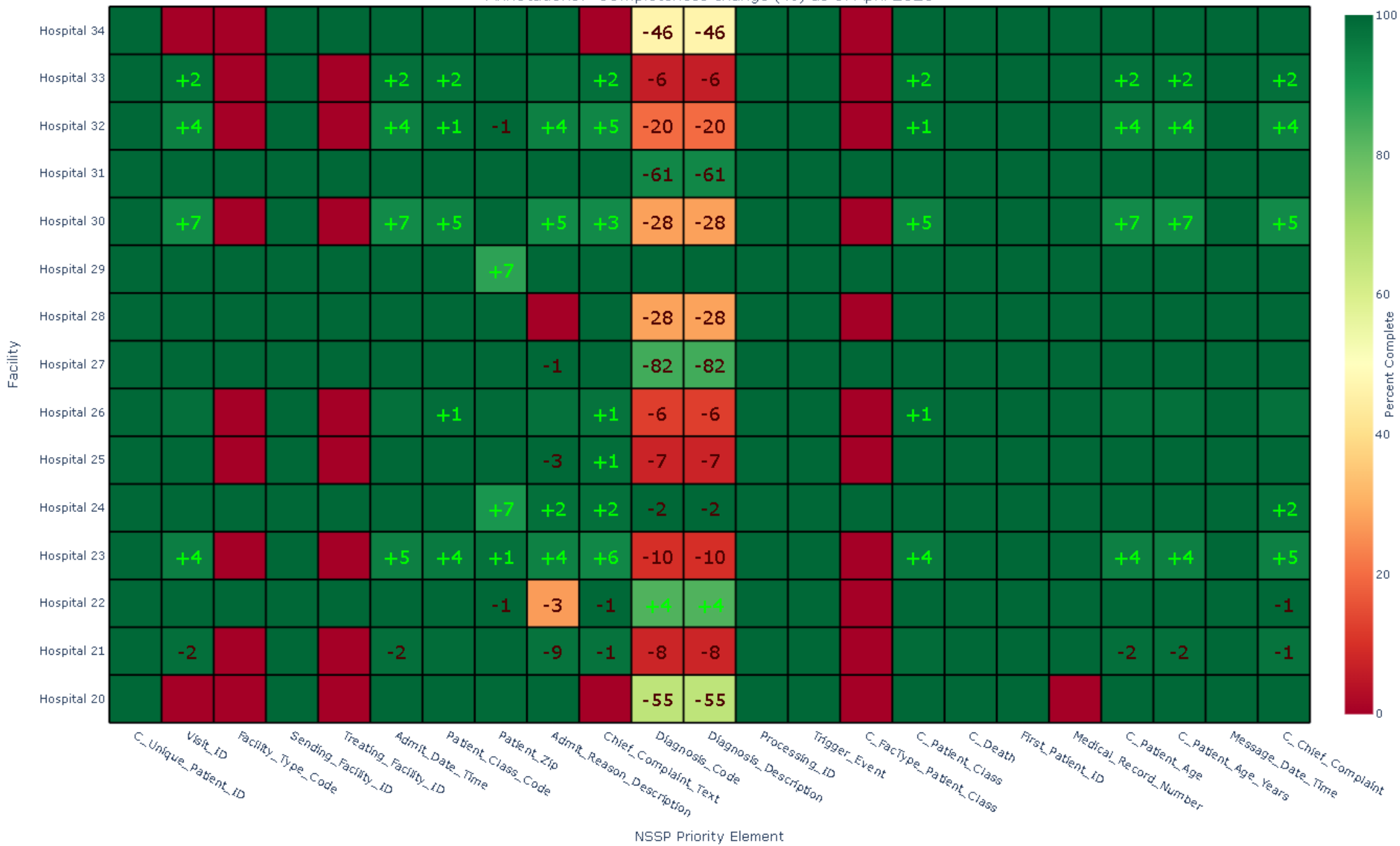
2a Visualization_interactive

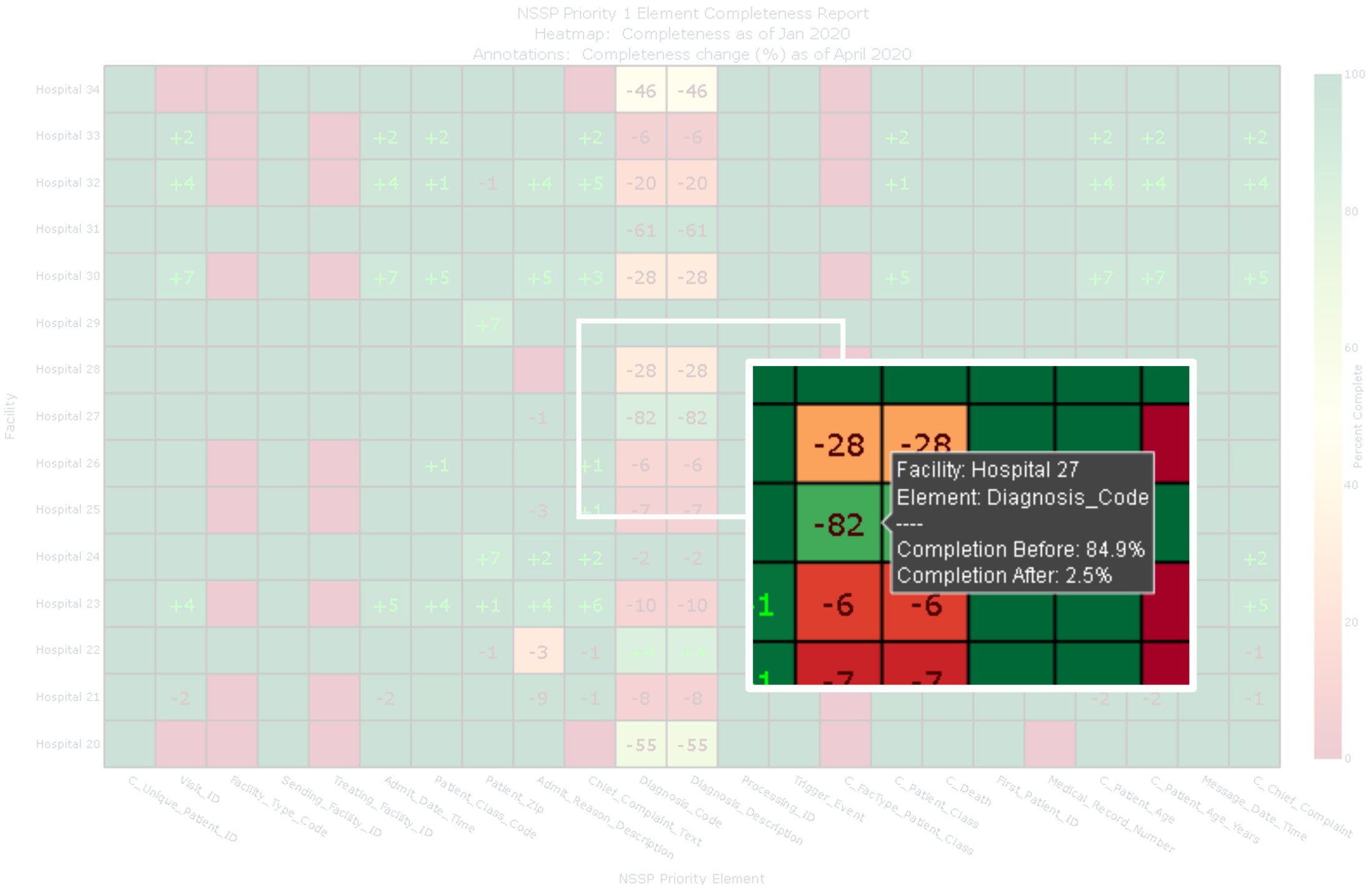
- Compares NSSP priority element completion across 2 time periods

- Heatmap expresses:
  - y-axis : facility names
  - x-axis : NSSP priority elements
  - color : completion from time1 (%)
  - annotation: completion2 – completion1

- Can be saved as interactive HTML file




NSSP Priority 1 Element Completeness Report
Heatmap: Completeness as of Jan 2020
Annotations: Completeness change (%) as of April 2020
Facility
Hospital 34 -46 -46
Hospital 33 +2 +2 +2 +2 +2 -6 -6 +2 +2 +2 +2
Hospital 32 +4 +4 +1 -1 +4 +5 -20 -20 +1 +4 +4 +4
Hospital 31 -61 -61
Hospital 30 +7 +7 +5 +5 +3 -28 -28 +5 +7 +7 +5
Hospital 29 +7
Hospital 28 -28 -28
Hospital 27 -1 -82 -82
Hospital 26 +1 +1 -6 -6 +1
Hospital 25 -3 +1 -7 -7
Hospital 24 +7 +2 +2 -2 -2 +2
Hospital 23 +4 +5 +4 +1 +4 +6 -10 -10 +4 +4 +4 +5
Hospital 22 -1 -3 -1 +4 +4 -1
Hospital 21 -2 -2 -9 -1 -8 -8 -2 -2 -1
Hospital 20 -55 -55
C_Unique_Patient_ID
Visit_ID
Facility_Type_Code
Sending_Facility_ID
Treating_Facility_ID
Admit_Date_Time
Patient_Class_Code
Patient_Zip
Admit_Reason_Description
Chief_Complaint_Text
Diagnosis_Code
Diagnosis_Description
Processing_ID
Trigger_Event
C_FacType_Patient_Class
C_Patient_Class
C_Death
First_Patient_ID
Medical_Record_Number
C_Patient_Age
C_Patient_Age_Years
Message_Date_Time
C_Chief_Complaint
NSSP Priority Element
Percent Complete
100
80
60
40
20
0


NSSP Priority 1 Element Completeness Report
Heatmap: Completeness as of Jan 2020
Annotations: Completeness change (%) as of April 2020
Facility
Hospital 34
Hospital 33
Hospital 32
Hospital 31
Hospital 30
Hospital 29
Hospital 28
Hospital 27
Hospital 26
Hospital 25
Hospital 24
Hospital 23
Hospital 22
Hospital 21
Hospital 20
C_Unique_Patient_ID
Visit_ID
Facility_Type_Code
Sending_Facility_ID
Treating_Facility_ID
Admit_Date_Time
Patient_Class_Code
Patient_Zip
Admit_Reason_Description
Chief_Complaint_Text
Diagnosis_Code
Diagnosis_Description
Processing_ID
Trigger_Event
C_FacType_Patient_Class
C_Patient_Class
C_Death
First_Patient_ID
Medical_Record_Number
C_Patient_Age
C_Patient_Age_Years
Message_Date_Time
C_Chief_Complaint
NSSP Priority Element
Percent Complete
100
80
60
40
20
0
Facility: Hospital 27
Element: Diagnosis_Code

Completion Before: 84.9%
Completion After: 2.5%

2b issues_in_messages

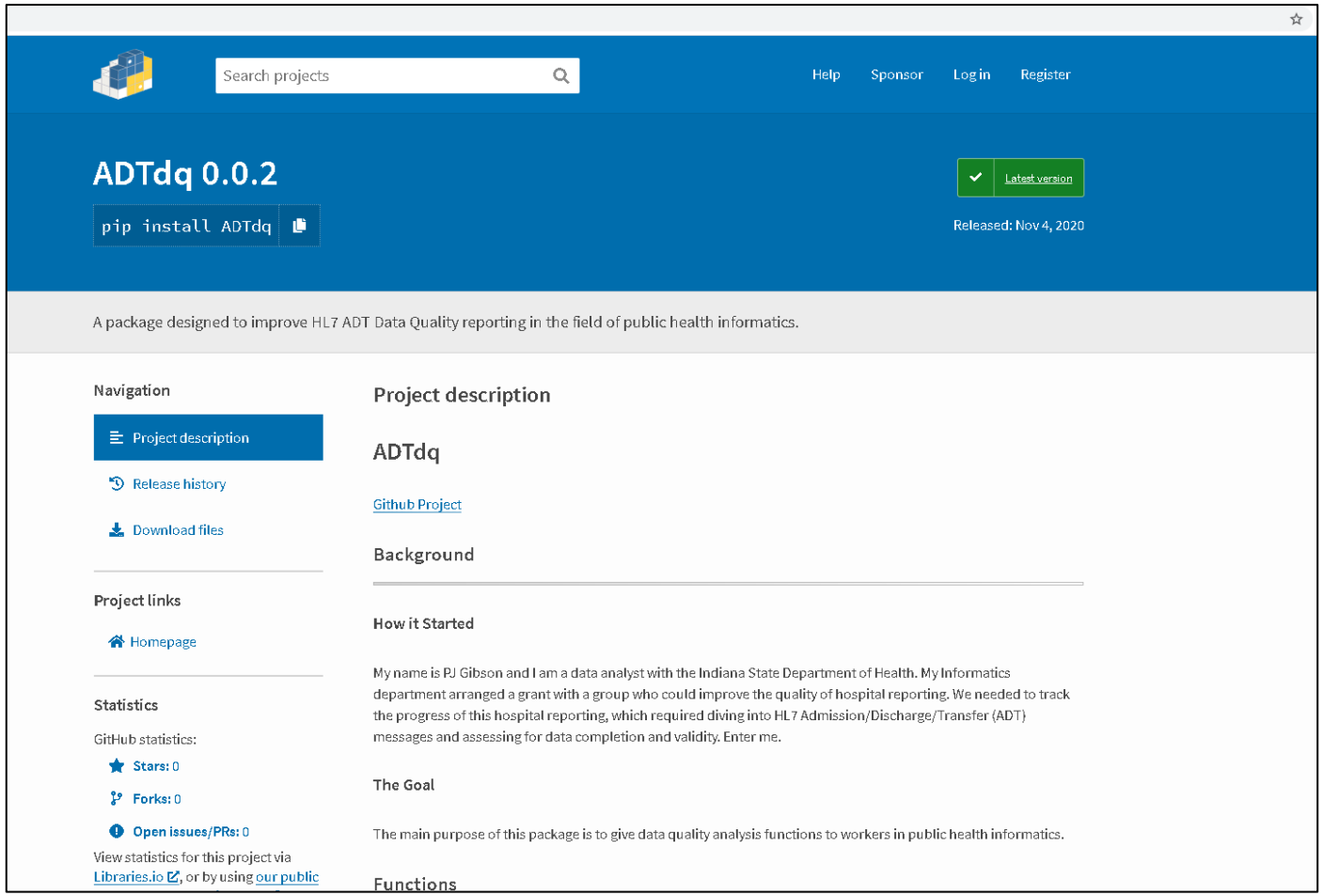
- Generates report on all errors in messages (missing or invalid)
- Can be exported neatly into Excel....may be large file

Grouper_ID	MESSAGE	Issue_Type	Element_Name	Priority	Description	Valid_Options	Message_Value	Suggestion	Comment
hospital|MRN|VisNum	some|complicated|message~blahblah|1	Missing or Null	Admit_Reason_Code	2	You must have a non-empty value for PV2-3.1 or PV2-3.4				
	some|complicated|message~blahblah|1	Invalid	Facility_Type_Code	1	You must have a OBX field where OBX-3 contains SS003 and where OBX-2='CWE'. When these criteria are met, the cooresponding OBX-5.1 or OBX-5.3 component must be non-empty	Value must be within the following list [261QE0002X, 1021-5 , 261QM2500X , 261QP2300X , 261QU0200X]	225XN1300X	261QP2300X	You want a Fac_Type_Code represting Primary Care. Your current value set version is out of date. See the following link: https://phinvads.cdc.gov/vads/ViewValueSet.action?id=43E2BA38-DFDE-E411-8970-0017A477041A

3 ADTdq – a Python library

https://pypi.org/project/ADTdq/

- Well documented on PyPi website
- Each function has lengthy descriptions with examples.
- Updates on horizon and as requested.



*Jupyter Notebook cell (python work environment)

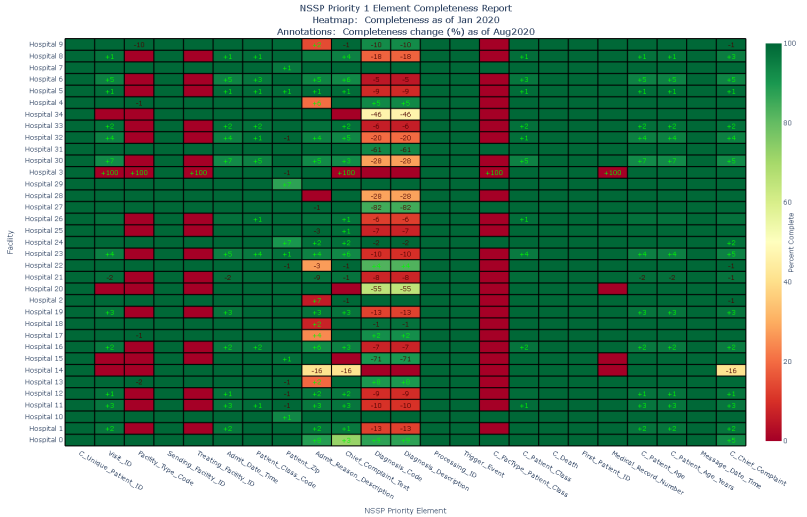
```python
# Import my package.  Includes pandas
from ADTdq import *

# Read in raw-data (includes HL7 ADT MESSAGE field)
jan_data = pd.read_csv('January_pull.csv',usecols=['MESSAGE','FACILITY_NAME','PATIENT_MRN','PATIENT_VISIT_NUMBER'])
aug_data = pd.read_csv('August_pull.csv',usecols=['MESSAGE','FACILITY_NAME','PATIENT_MRN','PATIENT_VISIT_NUMBER'])

# put through NSSP parser function
before = NSSP_Element_Grabber(jan_data)
after = NSSP_Element_Grabber(aug_data)

# impliment visualization
Visualization_interactive(before,after,['Jan 2020','Aug2020'],priority='1',show_plot=True,outfile=True)
```

Python, it's not so bad!



Questions?

* For un-answered questions, please email me at **PGibson@isdh.IN.gov**

Downloading Python & installing ADTdq

Download Anaconda here –

- contains multiple environments for coding in Python (jupyter, spyder, ect.)

Use Windows command prompt / terminal

- type in the following `pip install ADTdq`

Experiment yourself!

Request patches & updates?

National Syndromic Surveillance Program

Community of Practice

Advancing the Science and Practice of Syndromic Surveillance

Block Schedule

	Training	Methods	Innovation
1-1:15PM EST	Daily Opening, Logistics, Overview		
1:15-2PM EST	Training: Call Up Your Data Using APIs	Breakout: Querying from Scratch - Cooking Up New Syndromes	Training: Data Sharing Step-by-Step Using the AMC
	...BREAK...		
2:15-3PM EST	Training: Telling Your Story - Insights and Tips to Promote Syndromic Surveillance	Breakout: The Art of Surveillance - Data Visualizations	Lightning: New Tactics for Old Problems
	...BREAK...		
3:15-4PM EST	Training: Dashboard Creation in NSSP ESSENCE	Breakout: Making the Best of a SyS Situation - Data Quality for SyS	Roundtable: COVID, Current Events, and More - Discussing Syndromic Surveillance Practices in 2020
	...BREAK...		
4:15-5PM EST	Virtual Happy Hour		

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