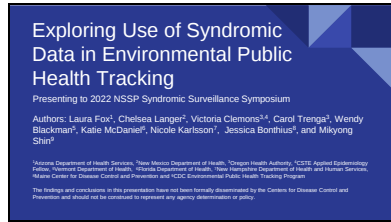


Slide 1



- Title: “Exploring Use of Syndromic Data in Environmental Public Health Tracking”
- Presenting to 2022 NSSP Syndromic Surveillance Symposium.
- Authors: Laura Fox¹, Chelsea Langer², Victoria Clemons^{3,4}, Carol Trenga³, Wendy Blackman⁵, Katie McDaniel⁶, Nicole Karlsson⁷, Jessica Bonthius⁸, and Mikyong Shin⁹

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The findings and conclusions in this presentation have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.

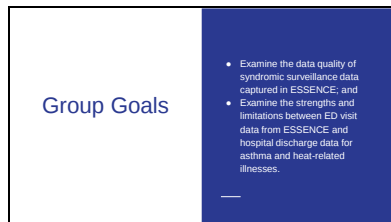
Slide 2



The CDC's Environmental Public Health Tracking Program (Tracking Program) tracks and disseminates environmental public health data to guide policy and practice. The Tracking Network has primarily relied on hospital discharge and emergency department (ED) visit data for its Nationally Consistent Data and Measures (NCDMs); however, these datasets are not available in near real time and rely on ICD-CM codes to define health conditions. In 2021-2022, ten Tracking Program jurisdictions joined a content workgroup to explore the use of syndromic surveillance (SS) queries as a supplemental data source.

33 recipients total

Slide 3



Group Goals:

- Examine the data quality of syndromic surveillance data captured in ESSENCE; and
- Examine the strengths and limitations between ED visit data from ESSENCE and hospital discharge data for asthma and heat-related illnesses.

Slide 4

Methods	
1.	Identified two ESSENCE query definitions per health condition
2.	Analysis strategy: - Positive predictive value (PPV) - Pearson's correlation coefficient (r) between data sources and queries - Daily temporal trend analysis between data sources
3.	Developed data pull guidance and sample SAS code
4.	Subteam members completed data analysis and shared results with group

The workgroup examined heat-related illness (HRI) and asthma ED visit queries in 2018-2019, with the option to include 2020. For HRI, two ESSENCE queries were examined using (1) the chief complaint and discharge diagnosis (CCDD “HRI v2” definition and (2) the ICD-10-CM T67, X30, X32, and not W92. For asthma, two ESSENCE queries were examined using (1) the CCDD “CDC Asthma v1” definition and (2) the ICD-10-CM J45. Analytic methods included calculating the positive predictive value (PPV), Pearson’s correlation coefficient, daily temporal trends between data sources, and examining demographic comparisons (age, sex, race, ethnicity).

Slide 5

Heat-related illness: ESSENCE Queries			
ESSENCE Filter	Query 1	Query 2	ED Data (following NCDM guidelines)
Data Source	Facility Location (full details)	Facility Location (full details)	Inpatient and Outpatient Data sources for ED Visits
Years	2018, 2019	2018, 2019	2018, 2019
Months	May 1 – Sept 30 (by admission date)	May 1 – Sept 30 (by admission date)	May 1 – Sept 30 (by admission date)
Has Been Emergency	Yes	Yes	ED Visits Only
Patient Location (primary for patient residence)	Yes/No	Yes/No	State residents
CCDD Category	CCDD Heat Illness V2	None	
Discharge Diagnosis (ICD-10)	T67, X30, X32, not W92	T67, X30, X32, not W92	
Has Been Outpatient	No (if applicable)	No (if applicable)	

Note: 2018 and 2019 years. Query 1 looked at the CCDD category “CCDD heat illness v2” whereas query 2 looked at specific discharge diagnoses that match the NCDMs submitted to CDC.

Slide 6

PPV values ranged from 60-84% for Query 1

Heat-Related Illness Query 1 Positive Predictive Values, by State and Year			
State	Year		
	2018	2019	2020
AZ	64%	67%	67%
KS	63%	71%	
NH	71%	84%	
NM	74%	75%	75%
OR	76%	71%	73%
VT	63%	60%	

PPV values 60-84% for Query 1 from 6 states between 2018 - 2020

The overall PPV values of “HRI V2” syndrome ranged from 60–84% for 2018–2020 (six states total). There was strong positive correlation for both the first ($r = 0.78–0.98$, $p < 0.001$) and the second ($r = 0.83–0.98$, $p < 0.001$) queries.

Slide 7

Query 1 & 2 ranged from $r = 0.78–0.98$

Pearson's Correlation Coefficient for ESSENCE Query 1 vs HRI NCDM ED Visits, by State and Year						
State	2018		2019		2020	
	r	p-value	r	p-value	r	p-value
AZ	0.92	<0.001	0.93	<0.001	0.92	<0.001
KS	0.94	<0.001	0.96	<0.001		
NM	0.84	<0.001	0.78	<0.001		
OR	0.96	<0.001	0.98	<0.001	0.95	<0.001

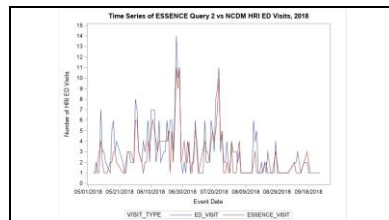
Pearson's Correlation Coefficient for ESSENCE Query 2 vs HRI NCDM ED Visits, by State and Year						
State	2018		2019		2020	
	r	p-value	r	p-value	r	p-value
AZ	0.92	<0.001	0.93	<0.001	0.94	<0.001
KS	0.95	<0.001	0.94	<0.001		
NM	0.85	<0.001	0.83	<0.001		
OR	0.98	<0.001	0.98	<0.001	0.95	<0.001

Query 1 correlation coefficient range $r = 0.78-0.98$, $p < 0.001$

Query 2 correlation coefficient range $r = 0.83 - 0.98$, $p < 0.001$

There was strong positive correlation for both the first ($r = 0.78–0.98$, $p < 0.001$) and the second ($r = 0.83–0.98$, $p < 0.001$) queries.

Slide 8



Example daily time trend from NM comparing query 2 (discharge diagnosis) and final NCDM data from 2018. All states had similar time trends; for HRI sometimes ESSENCE picked up more and other times NCDM captured more cases. Overall pretty similar.

Slide 9

Asthma: ESSENCE Queries			
ESSENCE Query Filters	Query 1	Query 2	HMO (Following NCDM guidelines)
Data Source	Facility Location (all details)	Facility Location (all details)	Inpatient & Outpatient data sources for ED visits
Years(s)	2018, 2019	2018, 2019	2018, 2019
Months	All	All	All
Has Been Emergency	Yes	Yes	ED visits only
Patient Location (primary for patient residence)	Yes	Yes	State residents
CCDD Category	CDC Asthma V1	None	
Discharge Diagnosis (ICD-10)	None	J45	J45* in primary diagnosis field
Has Been Outpatient	No	No	
Examine by Age Groups	A: 0-17, 18+ years B: 0-4, 5-17, 18-64, 65+	Either option A/B	A: 0-17, 18+ years B: 0-4, 5-17, 18-64, 65+

For our asthma work used the same approach as heat-related illness to define ESSENCE queries. The first query examined the CCDD Category CDC Asthma V1 and the second query used the DD category only searching for mentions of J45. In Tracking, we use J45 as primary diagnosis to track asthma related ED Visits. Since the DD field is not position specific like hospital discharge data, this was as close as we could get to our Tracking definition. Additionally, there was interest in examining age groups in this analysis, so different states examined children vs adults and/or smaller groups of <5, 5-17, 18-64, and 65+ years old.

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PPV values of Q1 ranged from 87 – 97%			
Asthma Query 1 Positive Predictive Values, by State and Year			
State	Year		
	2018	2019	2020
AZ	87%	89%	89%
KS	89%	95.6%	96.9%
NM	97%	96%	
OR	96.9%	96.9%	97.4%
VT	92%	88%	

Overall PPV of Q1 for all states ranged from 87 – 97% (5 states total)

When we examined the two age categories, we found similar ranges. Five states examined children vs adults and found a range of 76-95% for 17 years and younger and 88-97% for 18 years and older grouping. When we examined the 4 age categories of <5 years, 5-17 years, 18-64 years, and 65+ years, there were similar ranges for each age category across three years of data examined and 6 states data represented.

Slide 11

Correlation coefficients of Q1 vs. NCDM was highest in 2020

State	2018	2019	2020
AZ	0.09	0.38	0.85
KS	0.34	0.55	0.67
ME	0.59*		
OR	0.58	0.87	0.79

*Value calculated / combines years 2018-2019

The correlation coefficient of the first ESSENCE query vs NCDM varied by state but was highest in 2020 for three states ($r = 0.67-0.85$). The same pattern was true when comparing the second ESSENCE query vs NCDM. r was low for years 2018 and 2019 for states

Slide 12

Correlation coefficient was strongest for < 18 yr group

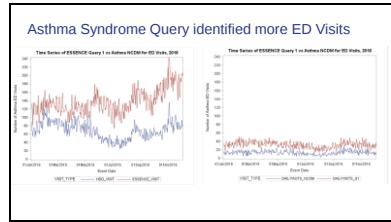
State	2018		2019		2020	
	0-17	18+	0-17	18+	0-17	18+
AZ	0.56	0.62	0.78	0.19	0.55	0.70
KS	0.49	0.15	0.56	0.22	0.58	0.14
NM	0.60	0.57	0.63	0.18		

State	2018				2019				2020			
	0-4	5-17	18-64	65+	0-4	5-17	18-64	65+	0-4	5-17	18-64	65+
AZ	0.69	0.85	0.58	0.50	0.65	0.76	0.22	0.14	0.50	0.63	0.12	0.53
KS	0.14	0.48	0.14	0.14	0.27	0.49	0.21	0.09	0.27	0.51	0.11	0.19
NM	0.47	0.58	0.54	0.39	0.44	0.56	0.23	0.22				

Examining correlation coefficient ESSENCE Q1 vs NCDM by Age Group Category A: There was stronger correlation in the 0-17 years age group compared to the 18+ years age group overall years (2018-2020) from 3 states.

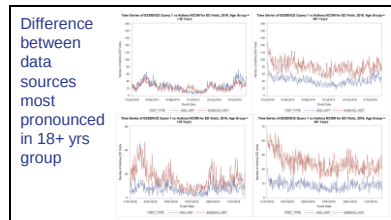
Examining correlation coefficient ESSENCE Q1 vs NCDM by Age Group Category B: The strongest correlation was found in the 5-17 year age group for all years (2018-2020) from 3 states. The weakest correlation was observed for 65+ years age group for all years (2018-2020) from 3 states.

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Asthma Syndrome Query identified more ED Visits compared to NCDM
Left is Arizona Q1 in 2019 and right is Maine Q1 in 2018

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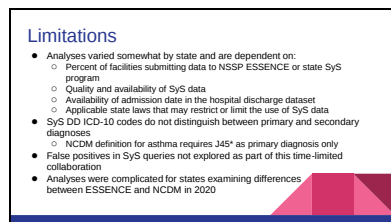


The top two time series are from Arizona and two bottom time series are from New Mexico.

Comparing Query 1 vs Asthma NCDM for 2018 shows good overlap for child age groups compared to 18+ age group where there is a clear distinction between the number of ED visits captured by ESSENCE compared to the frequency of visits captured in the hospital discharge dataset.

Reemphasize J45* in primary diagnoses for NCDM vs DD anywhere in field

Slide 15



- Analyses varied somewhat by state and are dependent on:
 - Percent of facilities submitting data to NSSP ESSENCE or state SyS program
 - Quality and availability of SyS data
 - Availability of admission date in the hospital discharge dataset

- Applicable state laws that may restrict or limit the use of SyS data
- SyS DD ICD-10 codes do not distinguish between primary and secondary diagnoses
 - NCDM definition for asthma requires J45* as primary diagnosis only
- False positives in SyS queries not explored as part of this time-limited collaboration
- Analyses were complicated for states examining differences between ESSENCE and NCDM in 2020

Slide 16

Conclusions and Next Steps

- CCDD "HRI v2" definition performs well for the states involved in this analysis
- CCDD "CDC Asthma v1" definition does not closely align with Tracking NCDMs
- Asthma syndrome definition should be further refined for age grouping specific analyses, such as children vs. adults
- Continue exploratory work examining syndromic data and uses for Tracking in new grant cycle



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 New Hampshire Environmental Public Health Tracking Program
 New Hampshire Public Health Emergency Preparedness Surveillance Program
 New Mexico Department of Health EPHT and Asthma Control Program
 Oregon Health Authority and Oregon Environmental Public Health Tracking Program
 Vermont Department of Health Division of Environmental Health and Division of Health Statistics and Informatics

Slide 18

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<https://www.cdc.gov/nceh/tracking/>

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