COVID Syndrome Definition Update

2:45PM EST | November 19th, 2020 | 2020 SyS Symposium

Moderators/Speakers:
Amanda Smith, PhD, MPH – CDC/NSSP (EIS Officer)
Zach Stein, MPH – ICF Consultant, CDC/NSSP
Michael Sheppard, MS – CDC/NSSP

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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USING SYNDROMIC SURVEILLANCE QUERIES TO SUPPORT THE COVID-19 RESPONSE

Amanda Smith, Michael Sheppard, Zach Stein, and Lakshmi Radhakrishnan

Centers for Disease Control and Prevention

Division of Health Informatics and Surveillance (DHIS)

NATIONAL SYNDROMIC SURVEILLANCE PROGRAM BIOSENSE PLATFORM

BY THE NUMBERS

73%

Data from about 73% of the nation's emergency department visits are contributed to the NSSP BioSense Platform.

24

Within 24 hours of patient visits, data are available for analysis.

5K

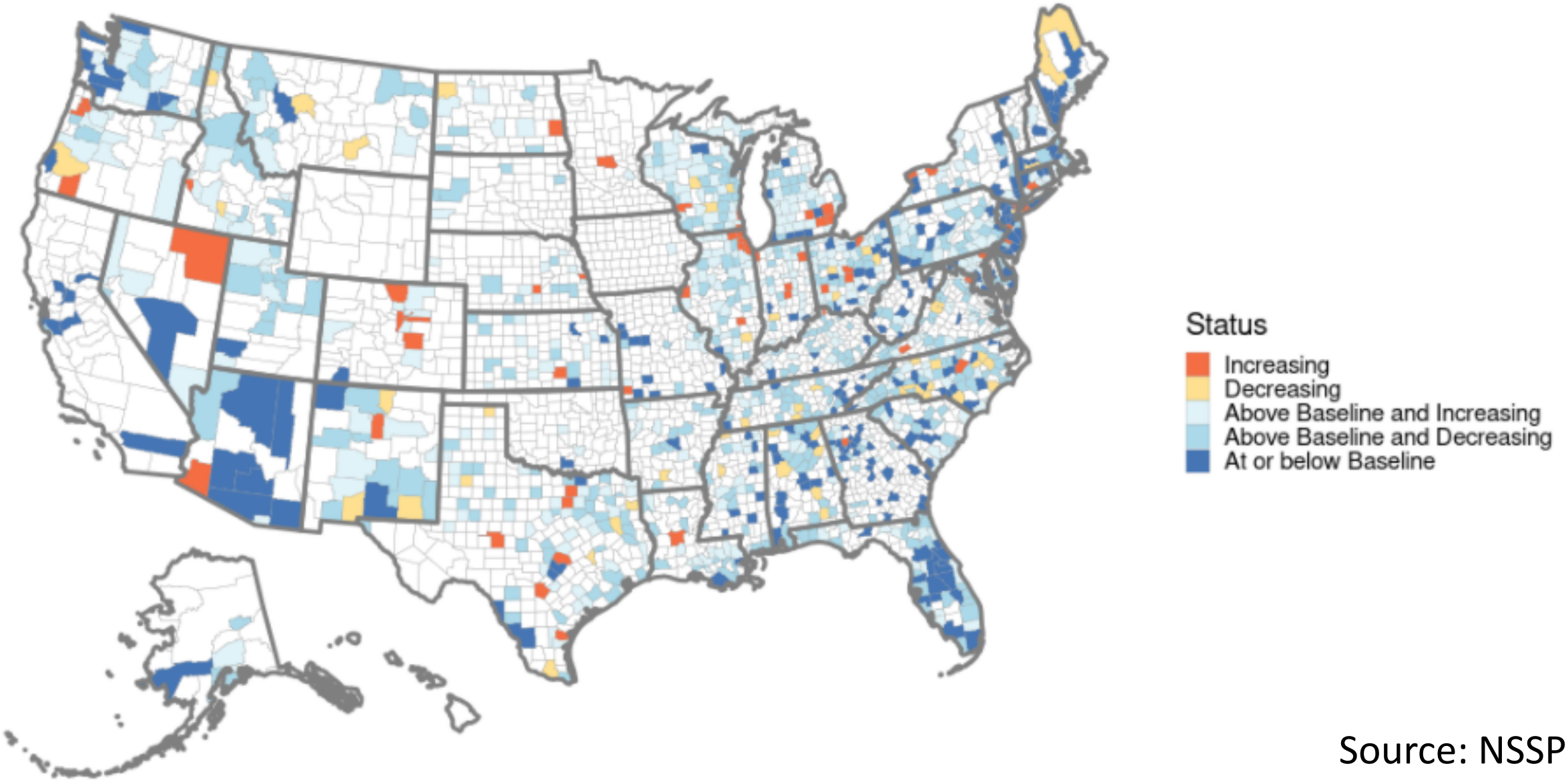
More than 5,000 health care facilities representing over 47 states and the District of Columbia contribute data to the NSSP BioSense Platform.

Syndromic Surveillance at the National Level for COVID-19 Response

- ESSENCE data
  - COVID-19 like illness (CLI)
  - Influenza like illness (ILI)
  - Coronavirus Discharge Diagnoses
  - Influenza Discharge Diagnoses
  - Pneumonia
- ESSENCE data R Shiny dashboard:
  - Combines data from ESSENCE, National Respiratory and Enteric Virus Surveillance System, and CDC Flu View

COVID-19 like illness Chief Complaint and Diagnosis Codes

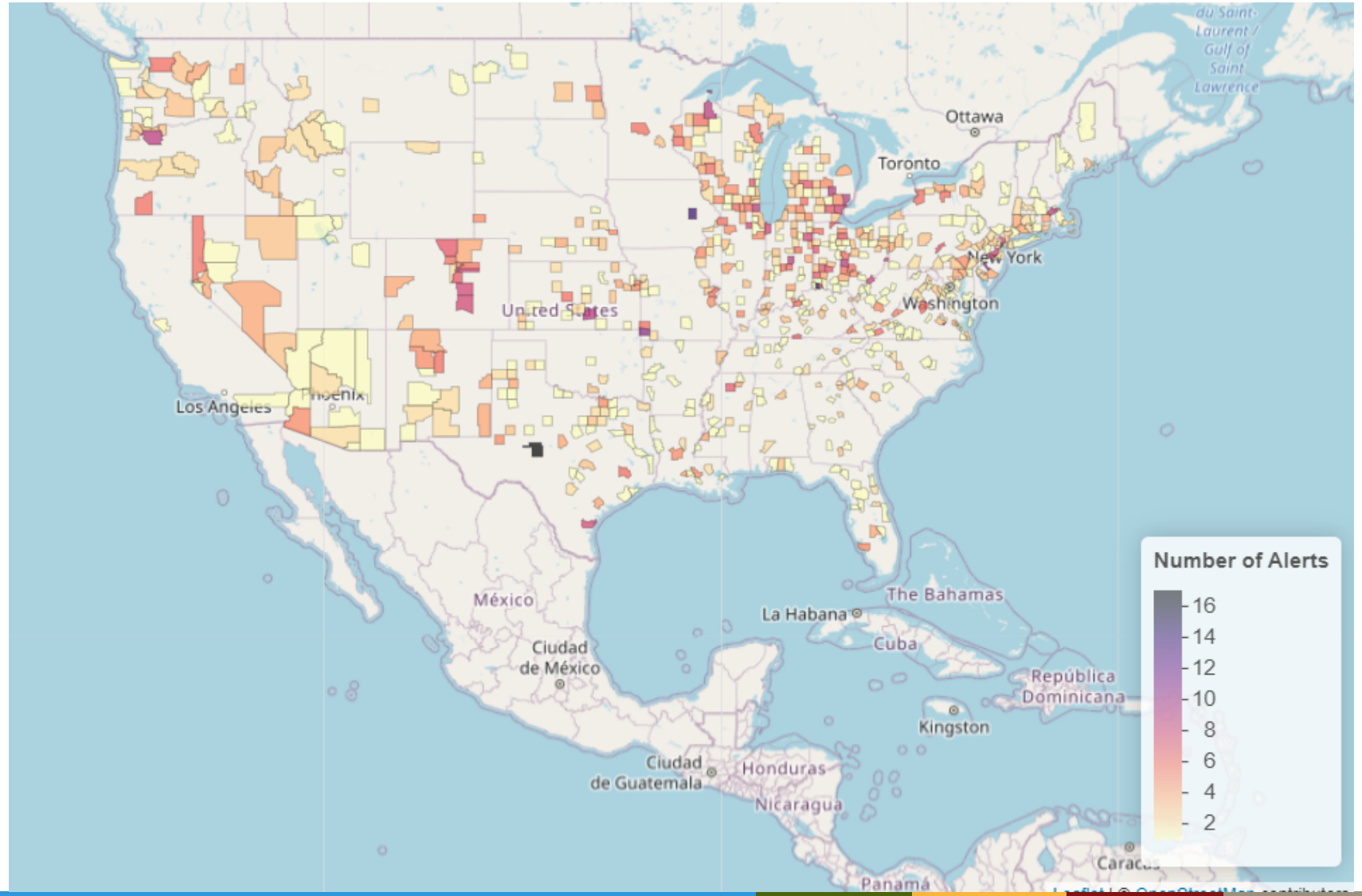
October 26, 2020-November 6, 2020



Source: NSSP

COVID-19 Related Alerts, by County

United States, November 3, 2020 to November 6, 2020



Syndromic Surveillance in Action

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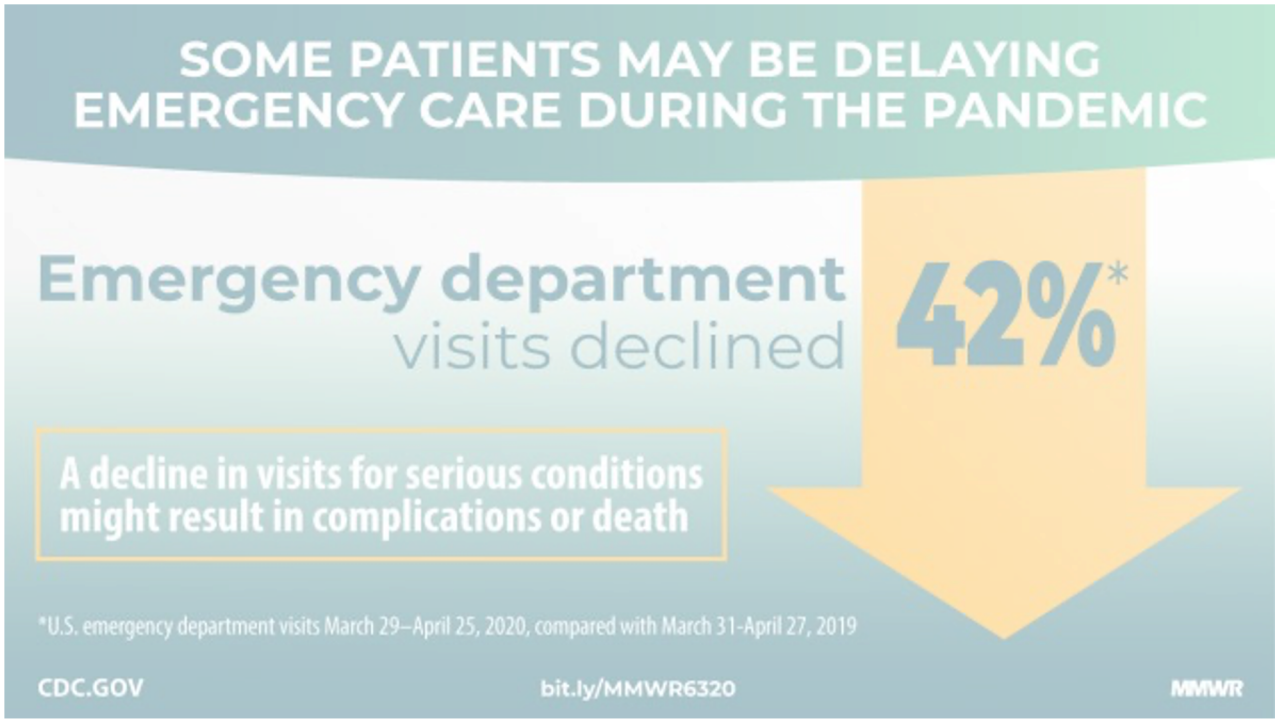
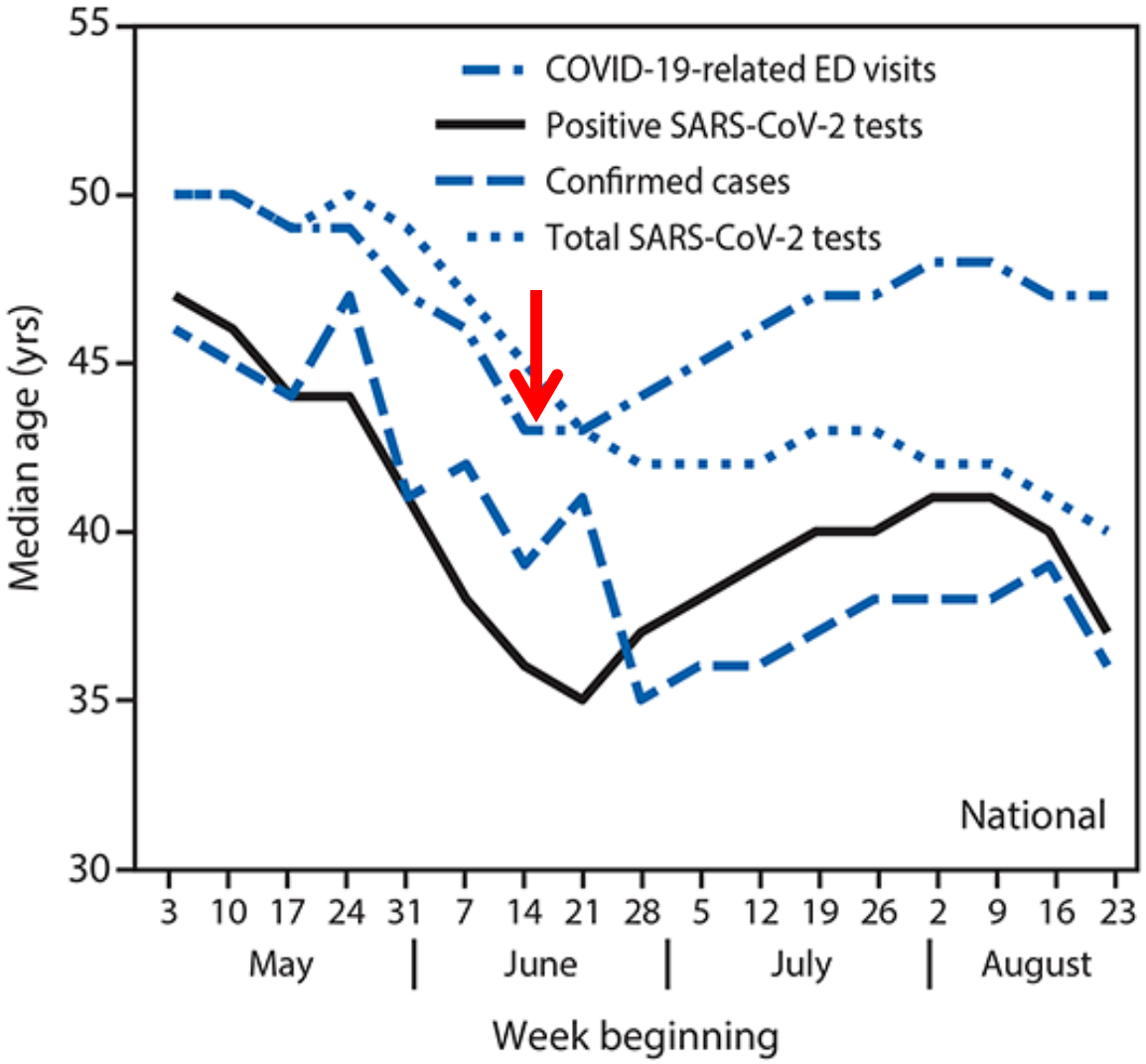
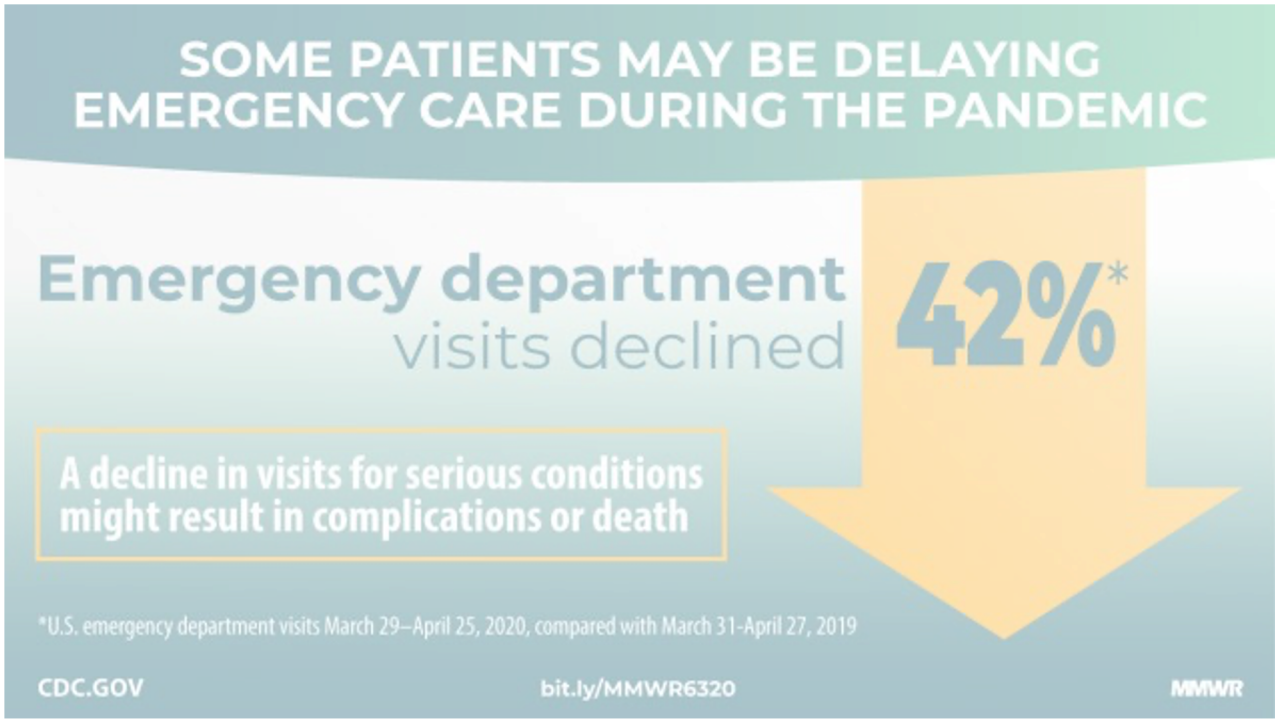


Morbidity and Mortality Weekly Report

Evidence for Limited Early Spread of COVID-19 Within the United States, January–February 2020

Syndromic Surveillance in Action





Morbidity and Mortality Weekly Report

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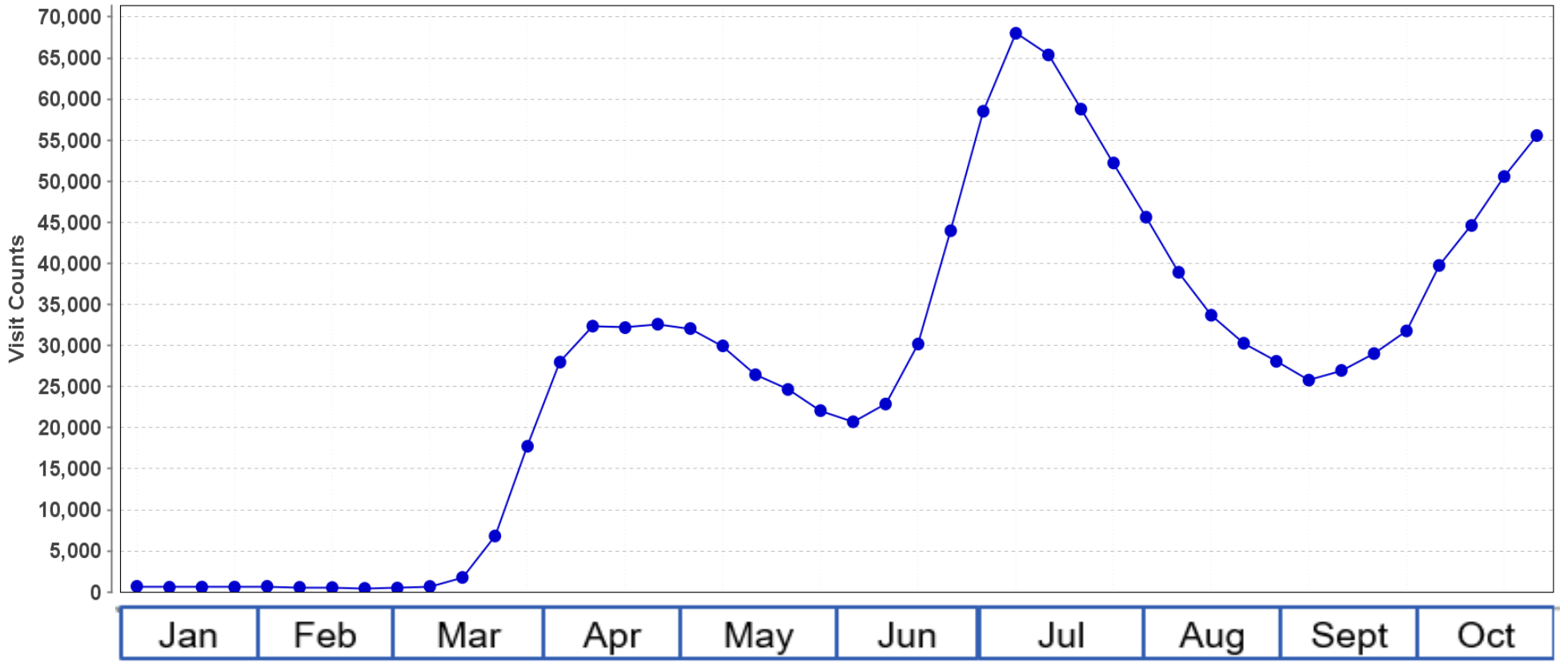
COVID-19 Syndromic Query Evolution

Initial Queries to Support State, Local, and CDC Preparedness and Response

- CDC Pneumonia Chief Complaint and Discharge Diagnosis version 1 – Available to users since January 2019
- Foreign Travel version 2 – Updates to Foreign Travel version 1
- CDC Influenza Discharge Diagnosis version 1 – Allowed for easier negation of positive influenza diagnoses
- Queries using ESSENCE chief complaint subsyndromes
  - Fever and Cough-Shortness of Breath-Difficulty Breathing version 1
  - Fever and Cough-Shortness of Breath-Difficulty Breathing negate Influenza diagnosis version 1
  - Influenza-like illness negate influenza mention version 1

CDC Coronavirus Discharge Diagnosis only, version 1 (Coronavirus-DD v1)

- Discharge Diagnosis query for any Coronavirus in ICD-10-CM, ICD-9-CM, and SNOMED
- Updated with U07.1 as coding guidelines and availability changed.



COVID-19-like Illness Chief Complaint with COVID-19-like Illness Discharge Diagnosis and Coronavirus Discharge Diagnosis version 1 (CLI CC and CLI CCDD v1)

Chief complaint:

Fever or Chills AND Cough

Or

Fever or Chills AND Shortness of Breath

Or

Fever or Chills AND Difficulty Breathing

+

Discharge diagnosis codes:

- Fever
- Cough
- Shortness of breath
- Sore throat
- Other specified respiratory disorders
- Acute respiratory distress
- Acute lower respiratory infection

Negations:

Influenza Discharge Diagnosis

COVID-19-like Illness Chief Complaint with COVID-19-like Illness Discharge Diagnosis and Coronavirus Discharge Diagnosis version 2 (CLI CC and CLI CCDD v2)

Chief complaint:

Fever or Chills AND Cough

Or

Fever or Chills AND Shortness of Breath

Or

Fever or Chills AND Difficulty Breathing

+

Discharge diagnosis codes:

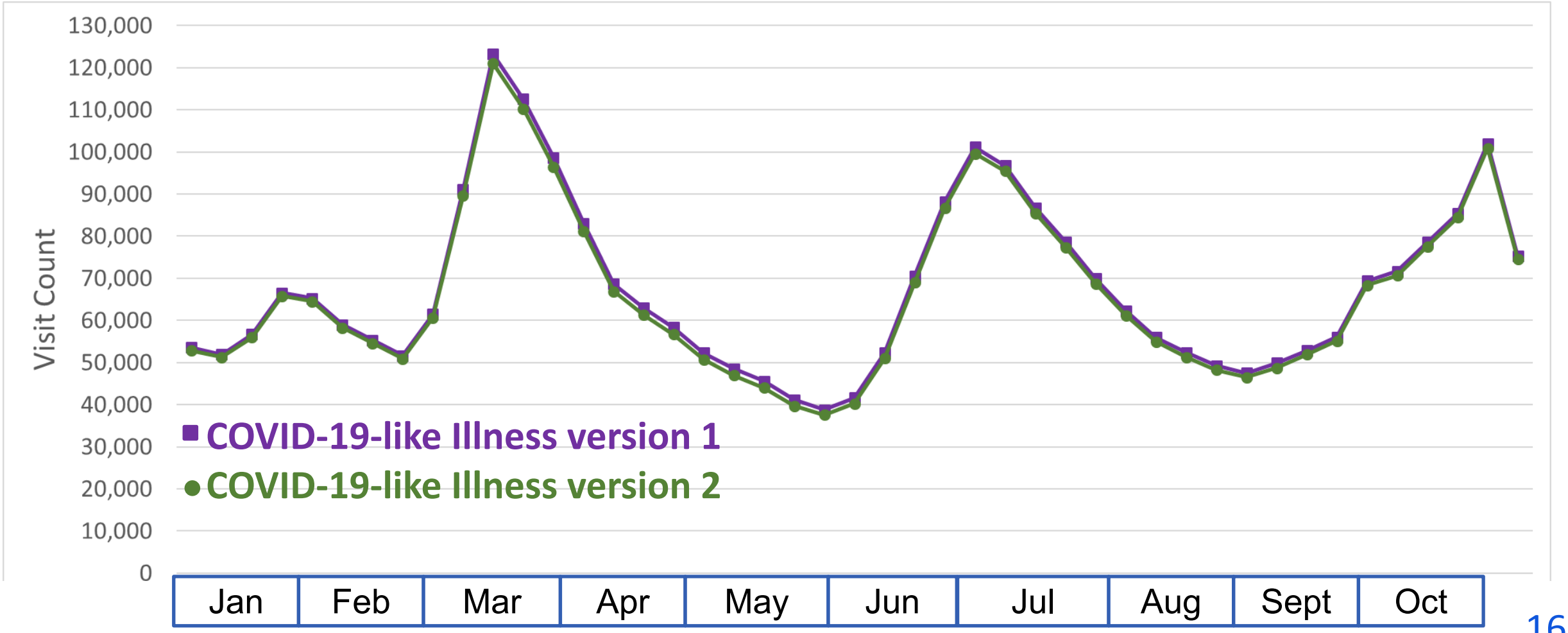
- Fever
- Cough
- Shortness of breath
- Sore throat
- Other specified respiratory disorders
- Acute respiratory distress
- Acute lower respiratory infection

Negations:

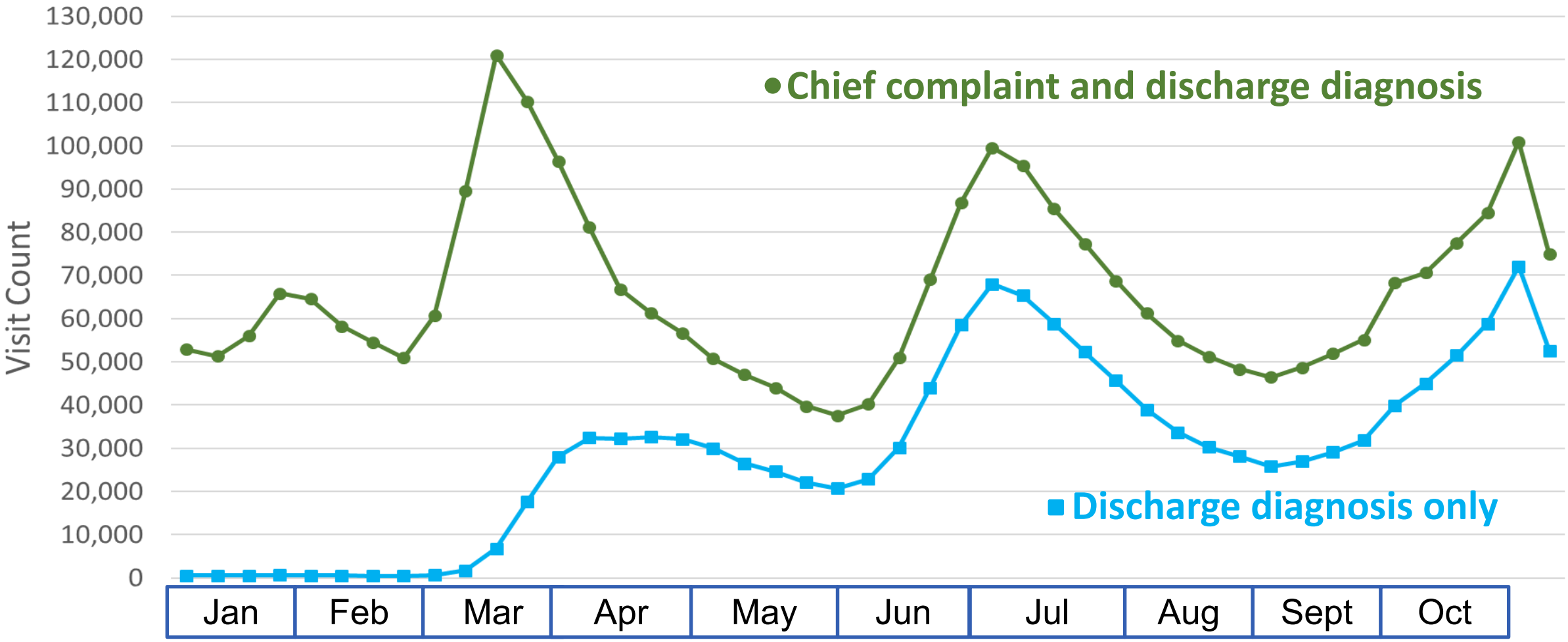
Influenza

Terms that indicate patient denies fever

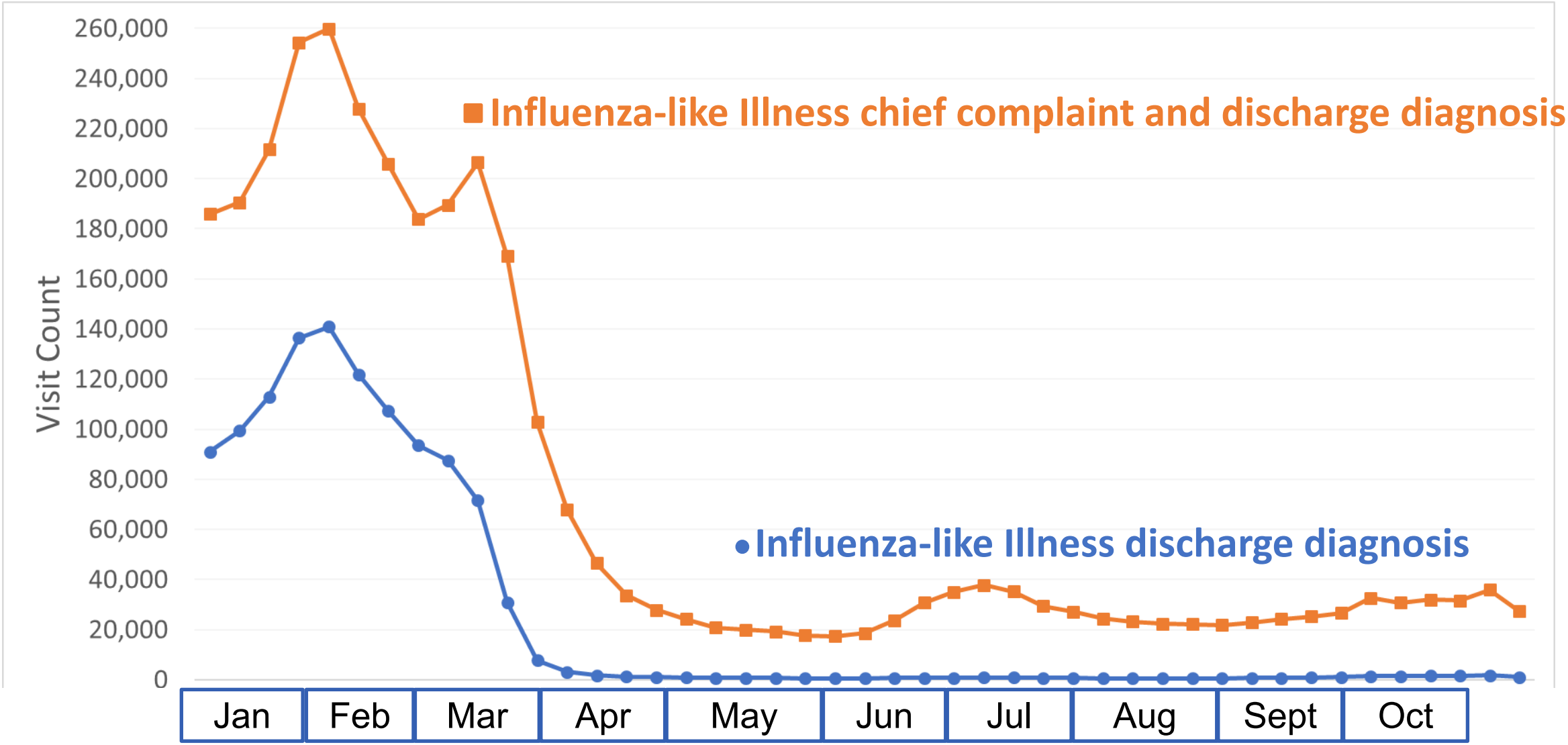
National Comparisons of Visit Trends for COVID-19-like Illness version 1 and version 2, January-October 2020



National Trends for Coronavirus Discharge Diagnosis version 1 and COVID-19-like illness version 2, January-October 2020



National Comparisons of Visit Trends for Influenza Discharge Diagnosis v1 and Influenza-like Illness v1, Jan-Oct 2020



Loss of Taste and Smell

Chief complaint:

Taste
Smell
Loss/Lost
Can't/Cannot
Taste loss or changes (ageusia, hypogeusia, dysgeusia)
Smell loss or changes (anosmia, hyposmia, parosmia)
Disturbances of smell/taste

+

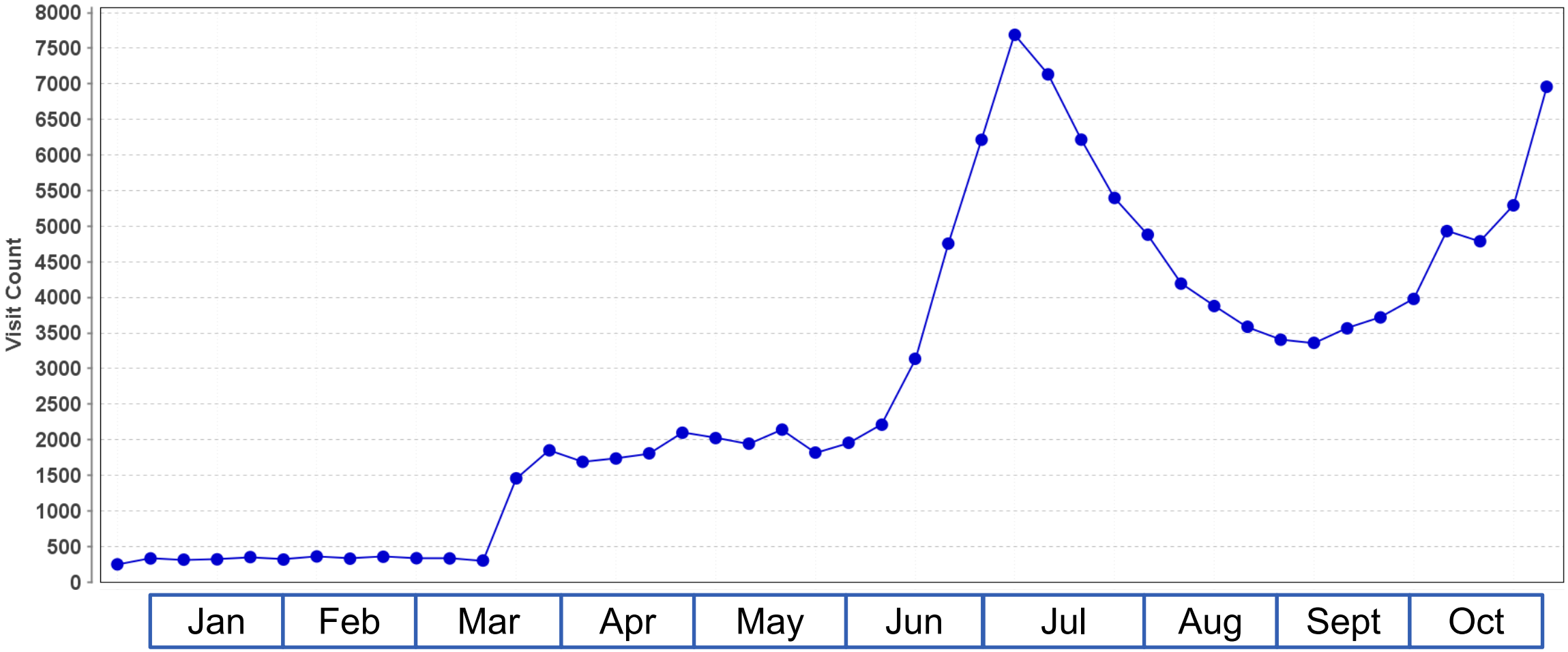
Discharge diagnosis codes:

Disturbances of smell and taste

Negations:

COVID questionnaires
Denies loss of taste or smell
Foul/Alcohol/THC
Smells/Smelling/Strong smell

National Visit Trends for Loss of Taste and Smell, Jan-Oct 2020



Syndromic Surveillance Query Evaluation

Utah Data

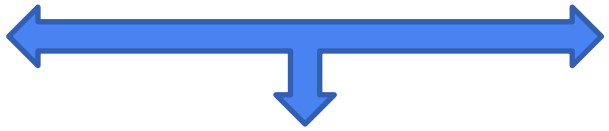
- 3 patient populations
  - COVID-19 positive patients (Jan 2020-Oct 2020)
  - Symptomatic COVID-19 negative patients (Jan 2020-Oct 2020)
  - Influenza positive patients (Oct 2019-April 2020)

Utah Data

- 3 patient populations
  - COVID-19 lab positive patients (Jan 2020-Oct 2020)
  - Symptomatic COVID-19 negative patients (Jan 2020-Oct 2020)
  - Influenza lab positive patients (Oct 2019-April 2020)
- 3 files
  - Visits (included chief complaint and lab result)
  - Diagnosis codes
  - Notes

Utah Data

Utah Visit Data:
N = 150,151



Utah NSSP Data:
N = 1,295,353

- 89% Utah visit records matched to NSSP records (N = 133,569)

Facility Type	Number of Visits
Emergency department	6,007
Primary care	557
Urgent care	127,032

Calculating Query Performance for COVID-19-like Illness

		Gold Standard: positive SARS-CoV-2 test	
CLI query		Yes	No
	Yes		
	No		

Calculating Query Performance for COVID-19-like Illness

		Gold Standard: positive SARS-CoV-2 test	
CLI query		Yes	No
	Yes	A: CLI flag AND Positive COVID-19 lab	
	No		

Calculating Query Performance for COVID-19-like Illness

		Gold Standard: positive SARS-CoV-2 test	
CLI query		Yes	No
	Yes	A: CLI flag AND Positive COVID-19 lab	B: CLI flag AND no Positive COVID-19 lab
	No		

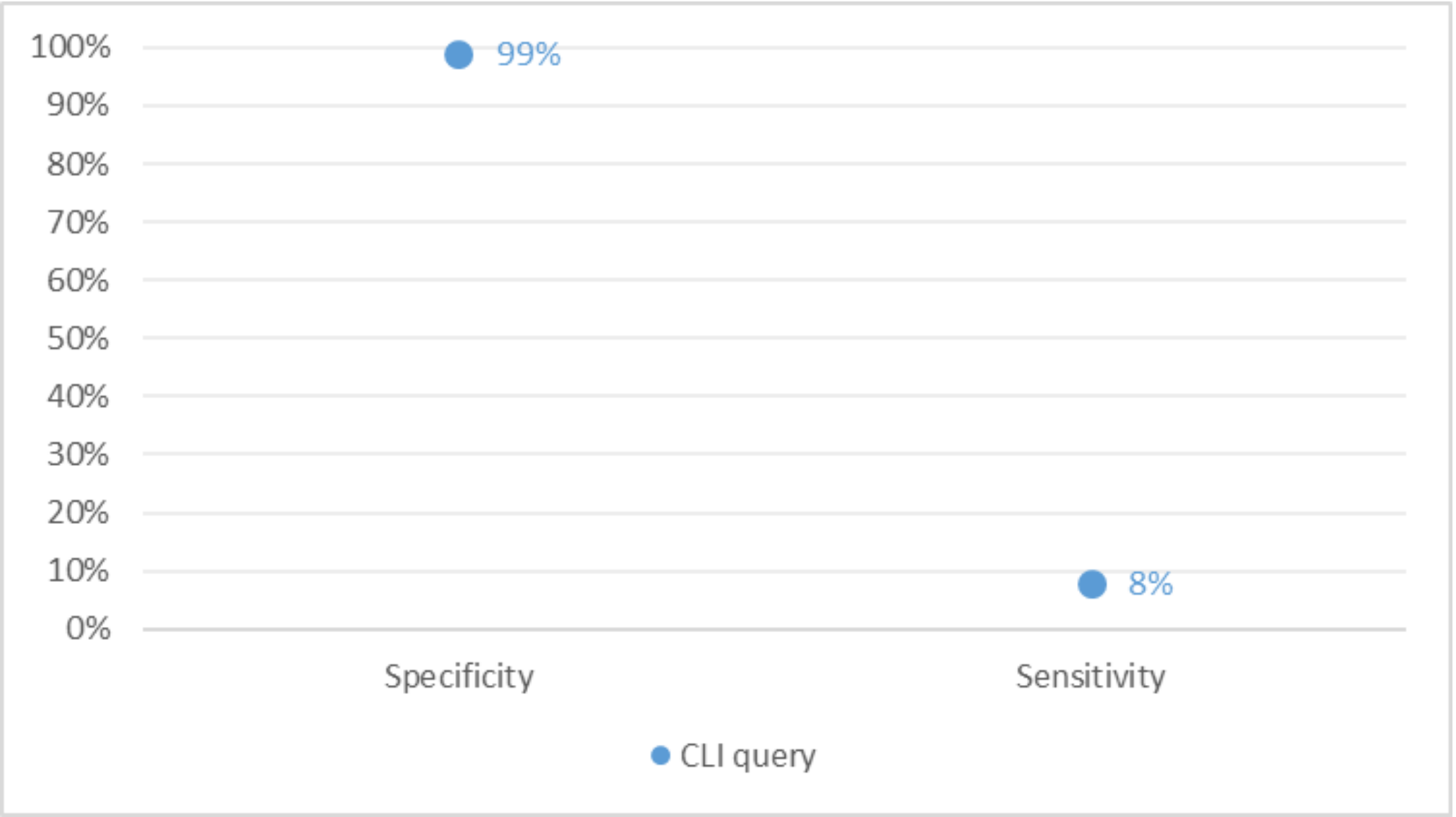
Calculating Query Performance for COVID-19-like Illness

		Gold Standard: positive SARS-CoV-2 test	
CLI query		Yes	No
	Yes	A: CLI flag AND Positive COVID-19 lab	B: CLI flag AND no Positive COVID-19 lab
	No	C: Not flagged for CLI AND Positive COVID-19 lab	

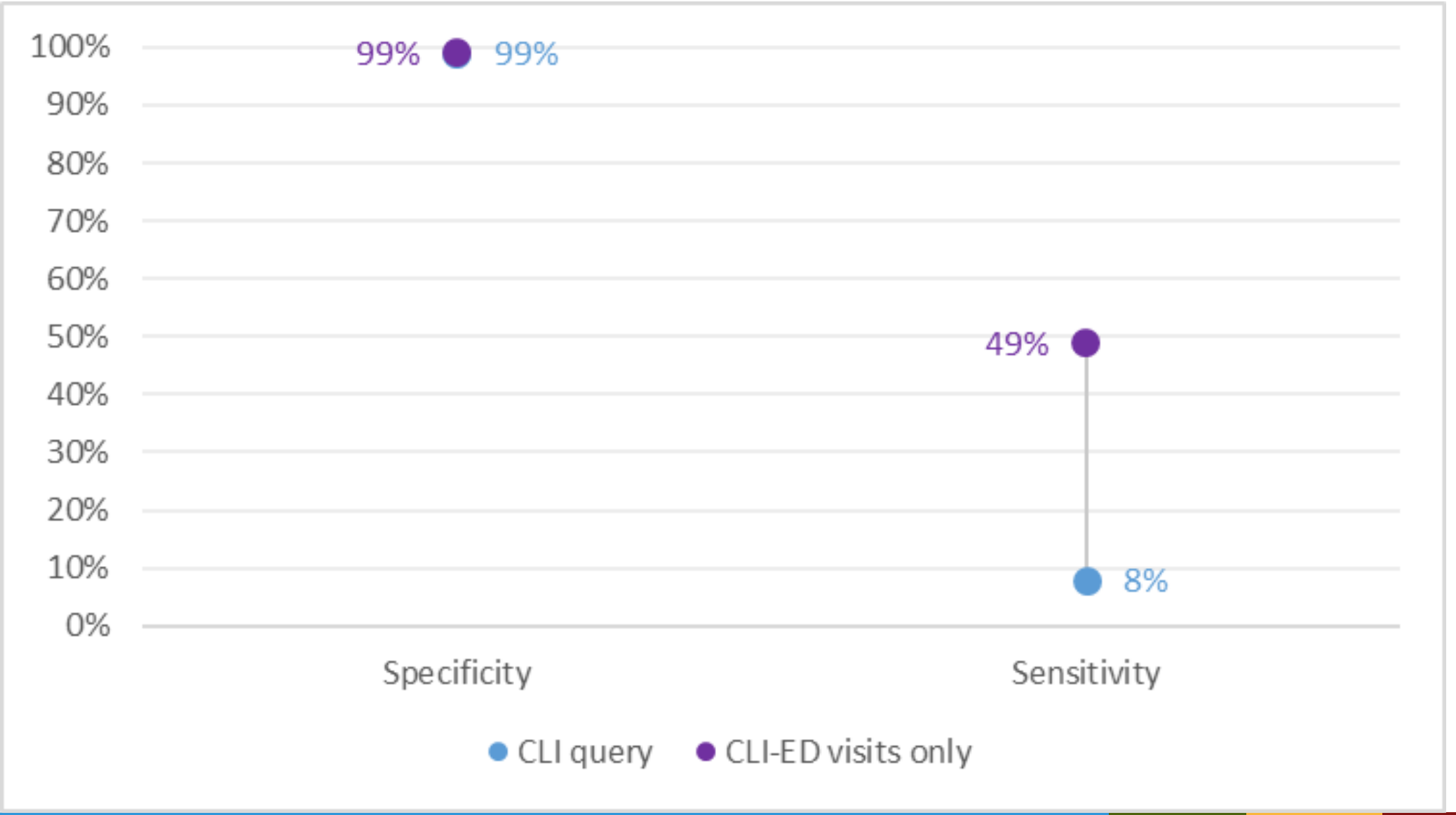
Calculating Query Performance for COVID-19-like Illness

		Gold Standard: positive SARS-CoV-2 test	
CLI query		Yes	No
	Yes	A: CLI flag AND Positive COVID-19 lab	B: CLI flag AND no Positive COVID-19 lab
	No	C: Not flagged for CLI AND Positive COVID-19 lab	D: Not flagged for CLI AND no Positive COVID-19 lab (all other records)

Current COVID-19-like Illness Query has High Specificity but Low Sensitivity when Searching All Visits



Restricting COVID-19-like Illness Query to ED Visits Greatly Improves Sensitivity

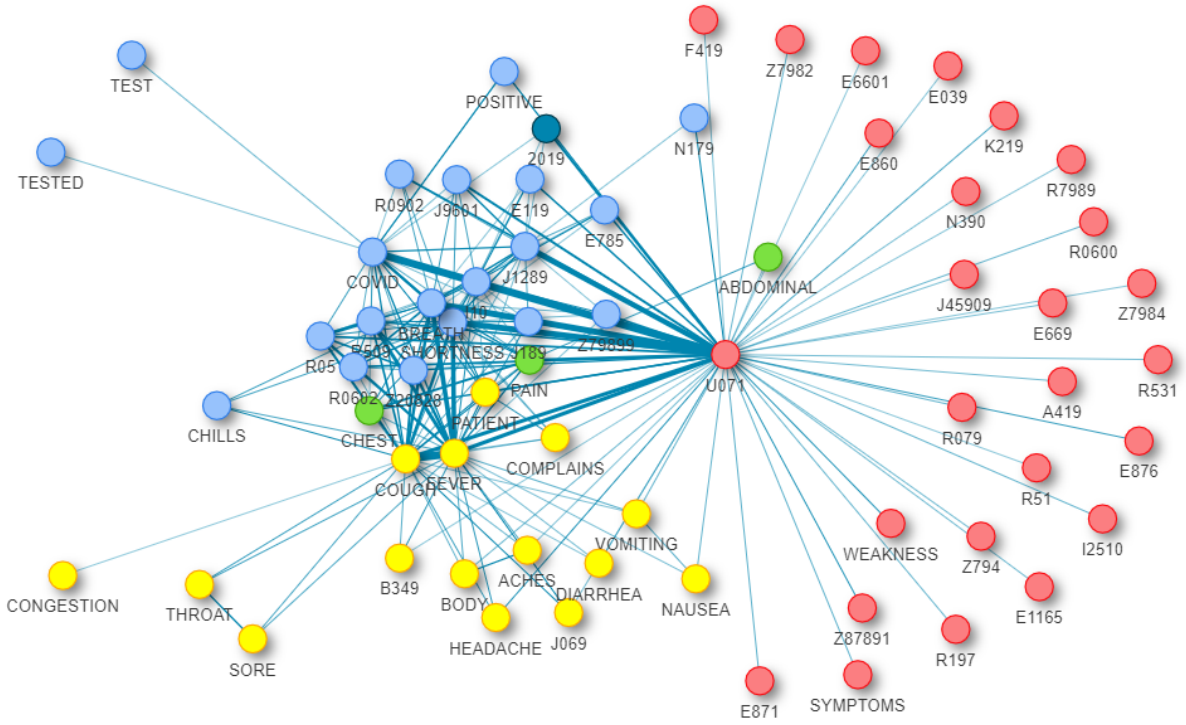


Getty Images

Text Analytics

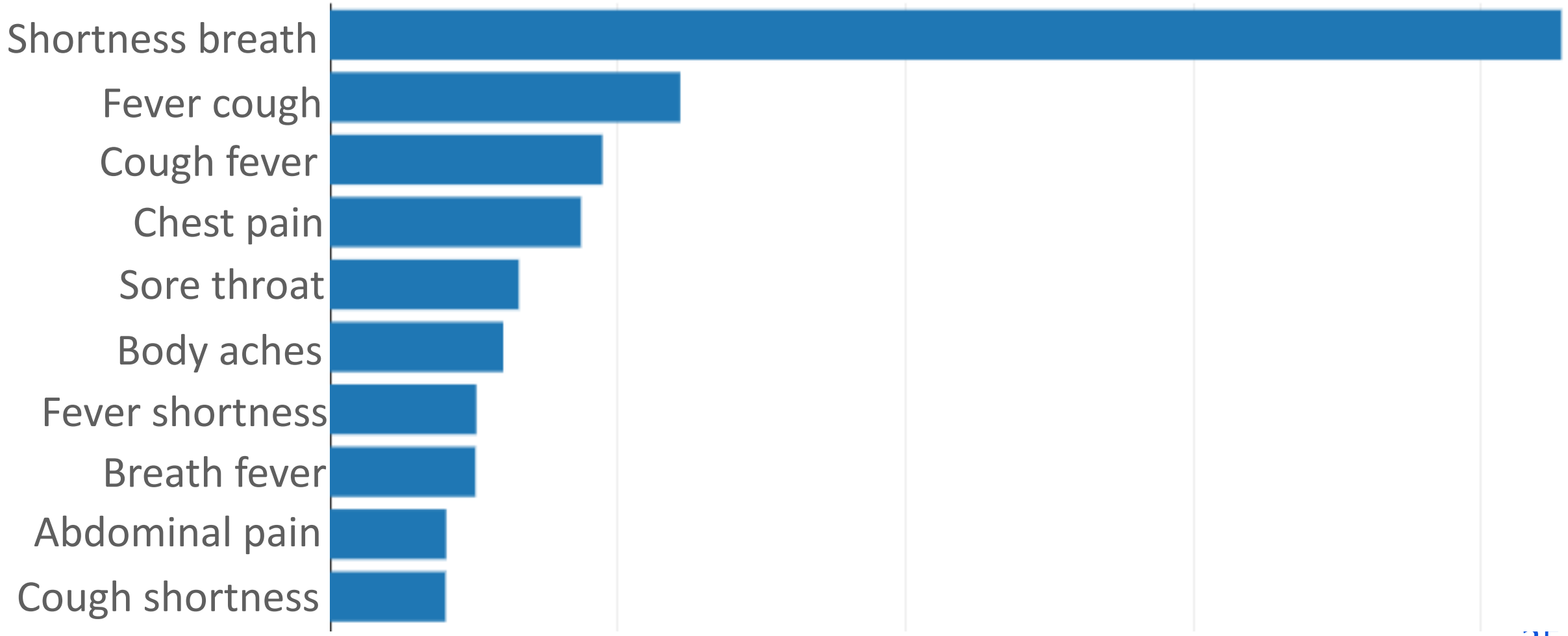
Text Analytics for Syndrome Definition Development and Validation

ESSENCE COVID-19-like illness version 2



Look at frequently co-occurring chief complaint and discharge diagnosis terms

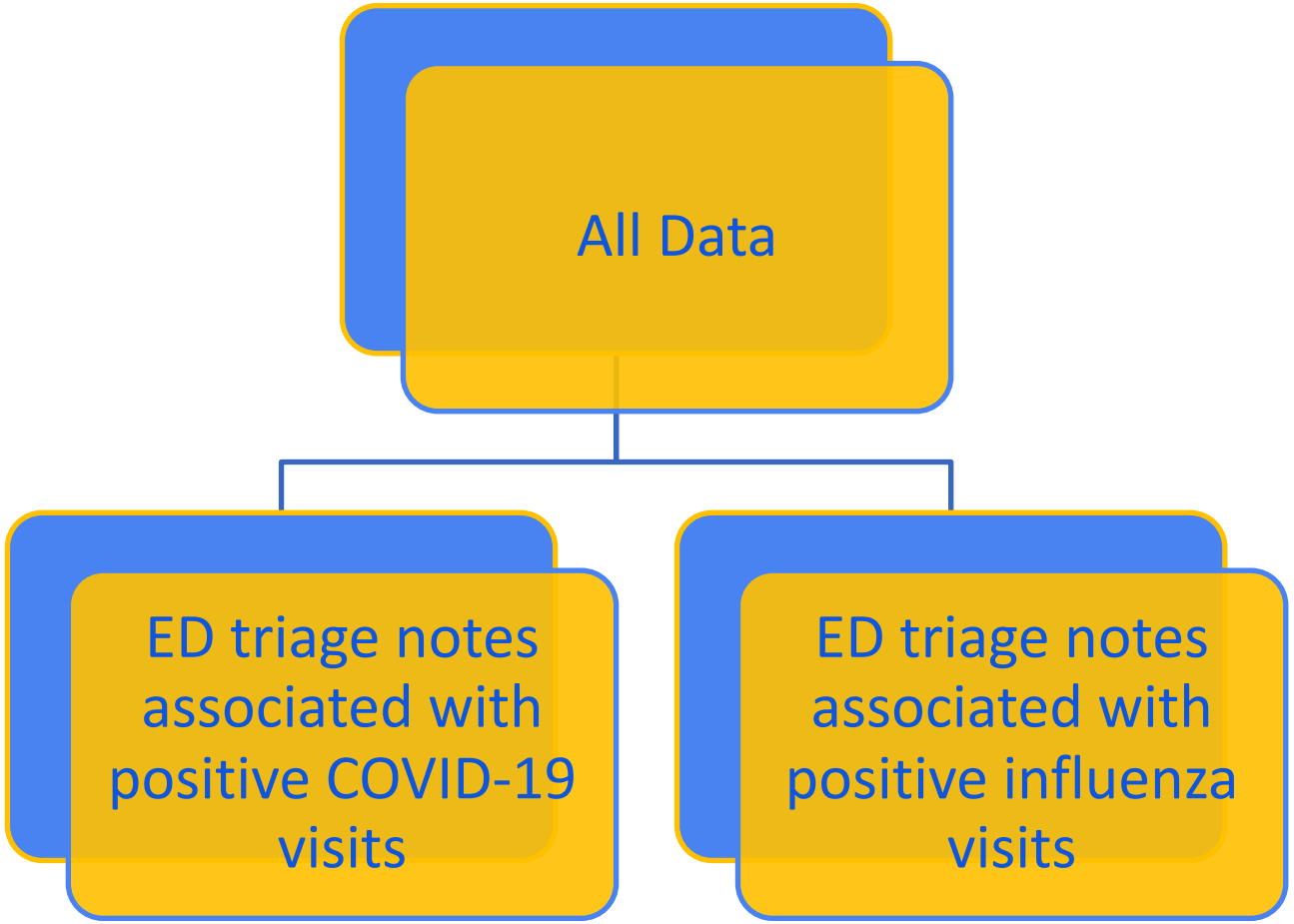
Top 10 Chief Complaint Bigram Frequencies – COVID-19-like Illness version 2



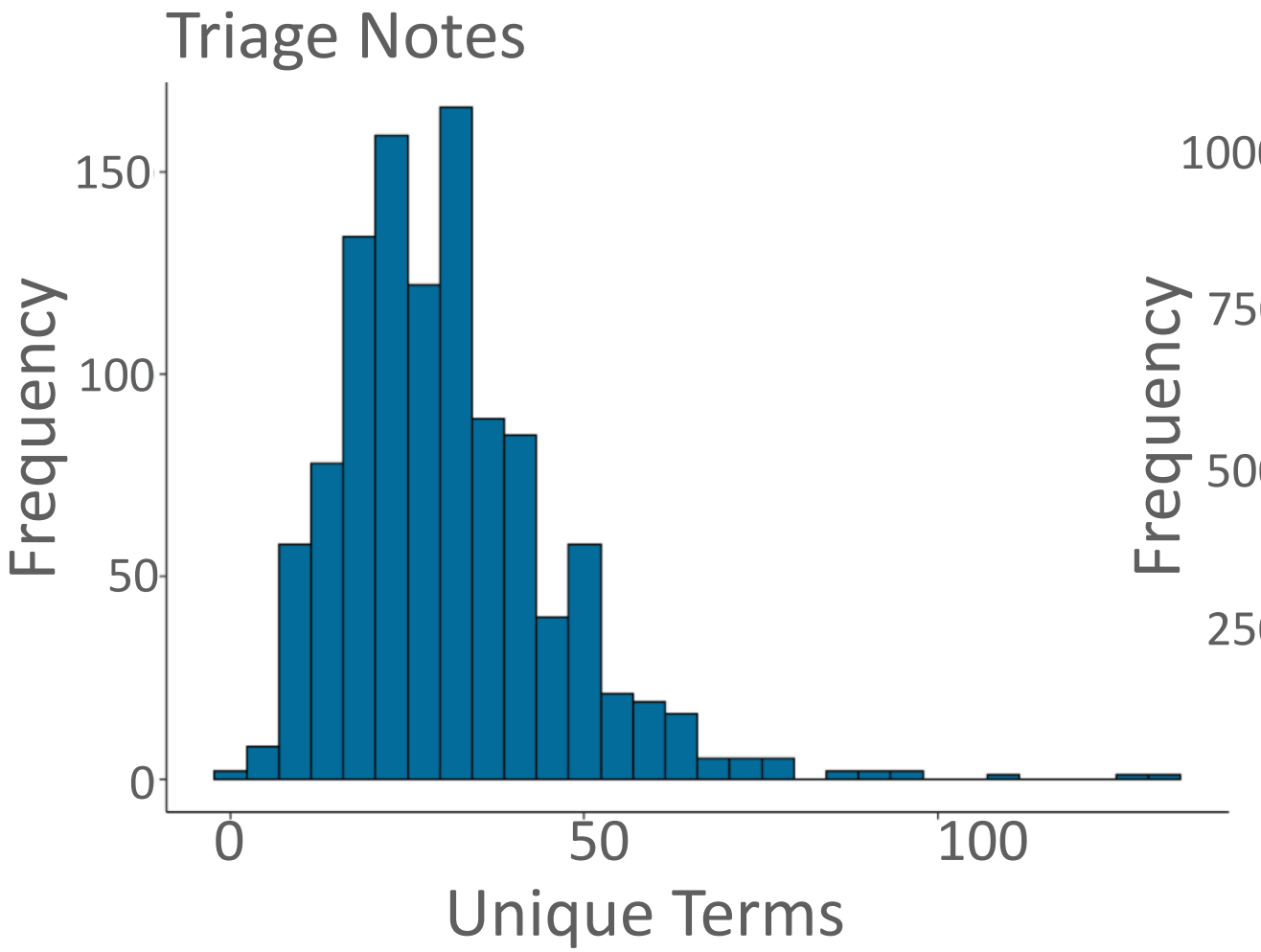
R Library “tidylo”

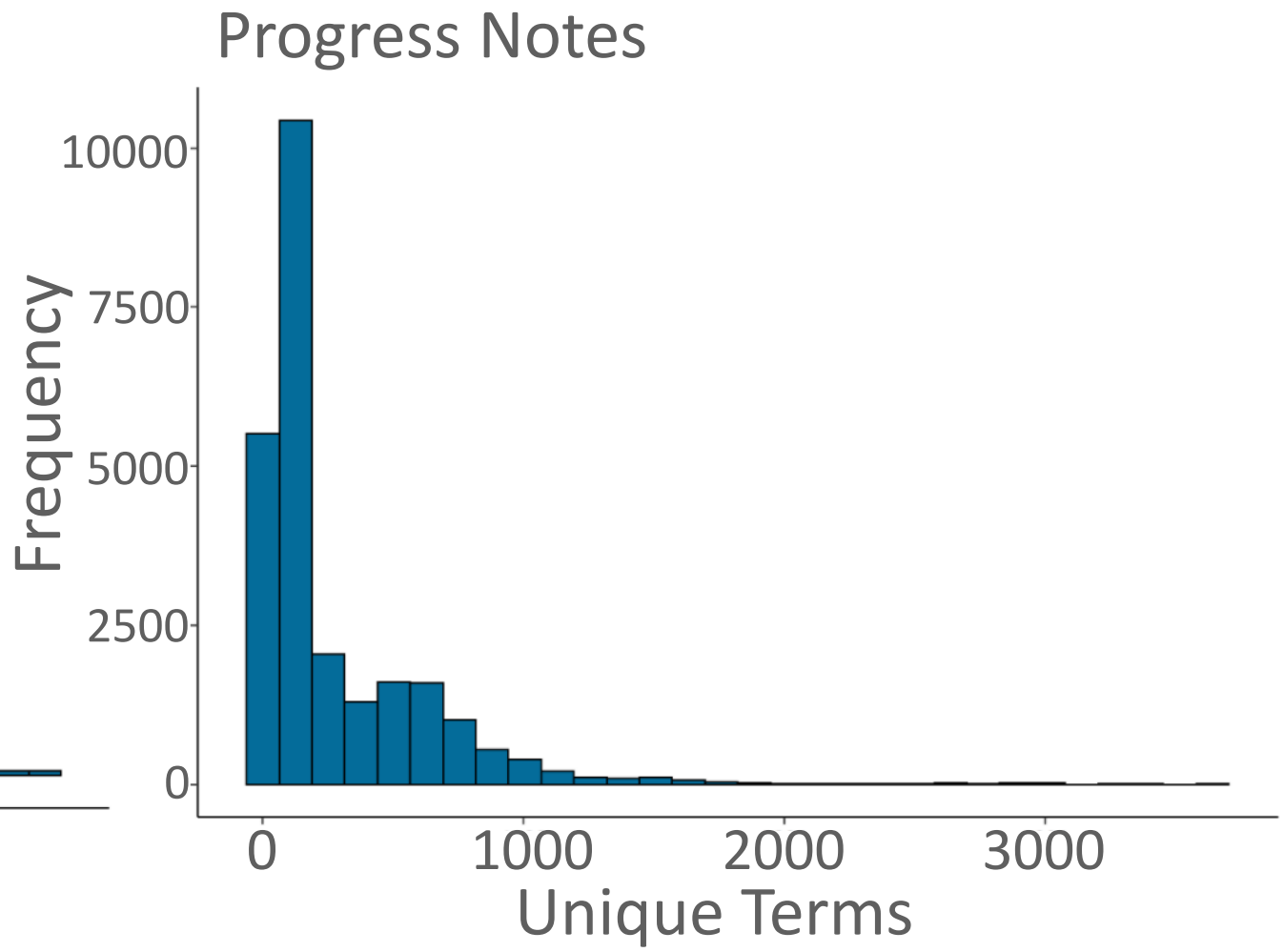
https://cran.r-project.org/web/packages/tidylo/tidylo.pdf

- **Description:**
  - Measure usage/occurrence of n-grams across groups
  - Use a model based, Bayesian approach to weight log odds
  - Informative prior: Best when amount of text data is sufficient across documents



Distribution of Unique Terms Across Note Types

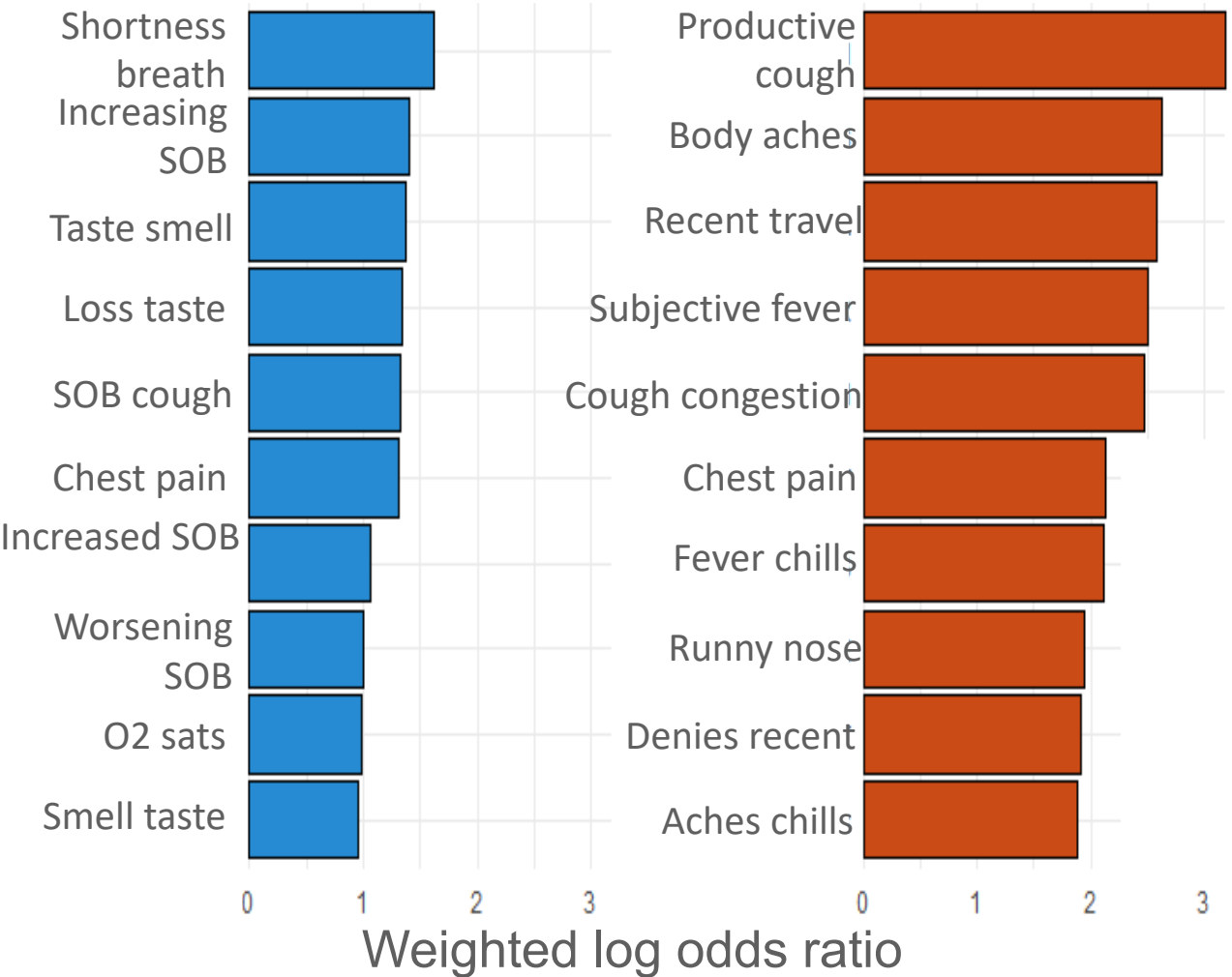




Note difference in scale on x-axis

Weighted Log Odds Analysis Applied to ED Triage Notes vs. ESSENCE Chief Complaint

Data Source: Utah Positive ED Triage Notes for COVID-19 and Influenza



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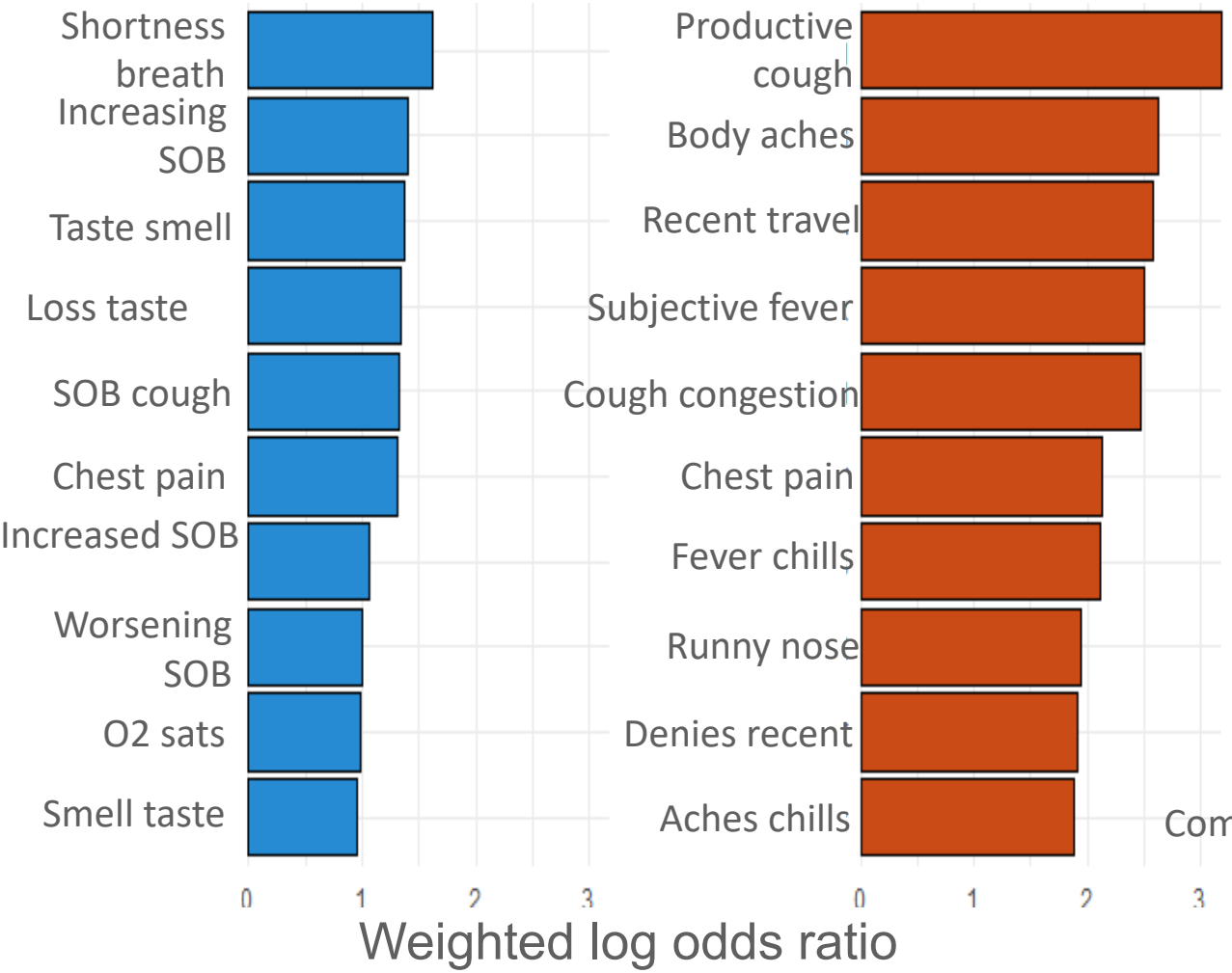
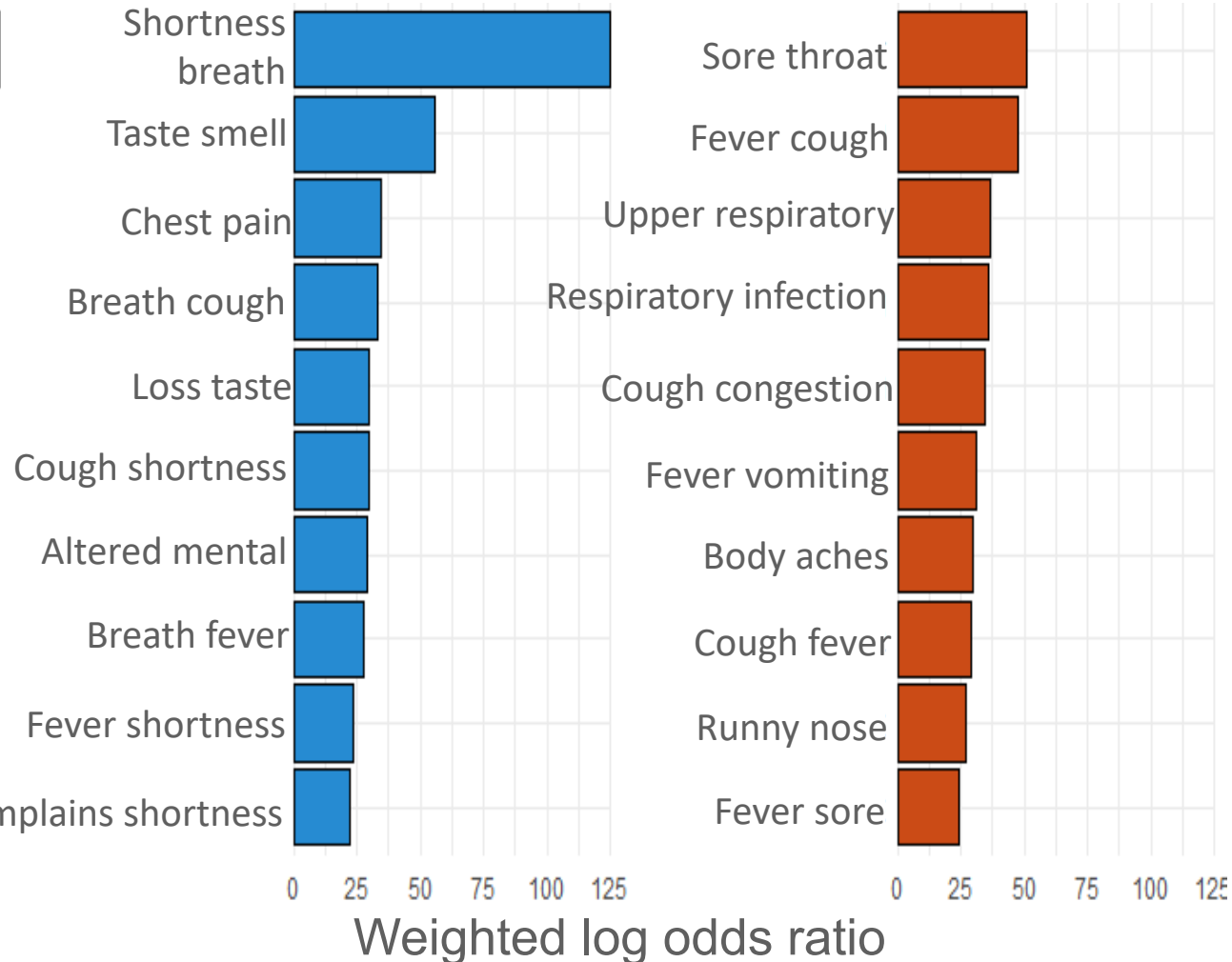


Data Source: ESSENCE Chief Complaints for Coronavirus-DD v1 vs. Influenza-DD v1



Conclusions

- CLI Syndromic Surveillance query has optimal performance when focusing on Emergency Department data
  - Drive-through testing = opportunity for improvement
- Text analysis findings from Utah notes are consistent with national analyses
- Use text analysis findings to further refine CLI and ILI queries
  - CLI: changes to taste and smell and hypoxia
  - ILI: fever and productive cough

Limitations

- Data matching
  - Patient records matching to >1 ESSENCE records
- Data limitations
  - Non-COVID visits (cell D) not fully captured in data pull
- Generalizability

Next Steps

- Expand analyses to other states
- Use text mining findings to further refine CLI queries
- Explore queries to capture drive-through testing
- Stratify text mining
  - Age
  - Race/ethnicity

Acknowledgements

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Eddie Stenehjem
Kassandra Wilson

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Community of Practice

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Block Schedule

1-1:15PM EST	Daily Opening, Logistics, Overview			
1:15-1:45PM EST	Plenary: NSSP and the Federal COVID Response			
1:45-2:30PM EST	Plenary Panel: Syndromic Surveillance during a National Emergency - the State and Local Experience			
	...BREAK...			
2:45-3:30PM EST	Breakout: COVID Syndrome Definition Update	Roundtable: Data Integration to Monitor COVID Vaccine Rollout	Roundtable: Data Quality and COVID	Demo/Technical Walkthrough: Analytic Innovations for the COVID Response - RShiny Dashboard
	...BREAK...			
3:45-4:15PM EST	Who We Are and Where We're Going - NSSP Community of Practice Participation and Strategic Framework			
4:15-4:45PM EST	Ongoing Activities - NSSP Community of Practice Subcommittee, Workgroup, and User Group Updates			
4:45-5:00PM EST	Looking Ahead - Engaging in the NSSP Community of Practice Moving Forward			
5PM EST	Symposium Closing Session			

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