The Pursuit of Validation

3:15 PM EST | December 7th, 2022 | 2022 SyS Symposium

Moderator:

- Amy Ising, MSIS – UNC Department of Emergency Medicine

Presenters:

- Abraham Ikejiofor, MPH – New York State Department of Health
- Stephanie Neal, MPH – Virginia Department of Health
- Nina Masters, PhD - CDC

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CSTE

Council of State and Territorial Epidemiologists

Abraham Ikejiofor, MPH
New York State Department of Health

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Develop Cannabis Syndrome to Monitor New York State (NYS) Hospital Emergency Department (ED) Cannabis-Related Visits after Its Legalization for Recreational Adult-Use

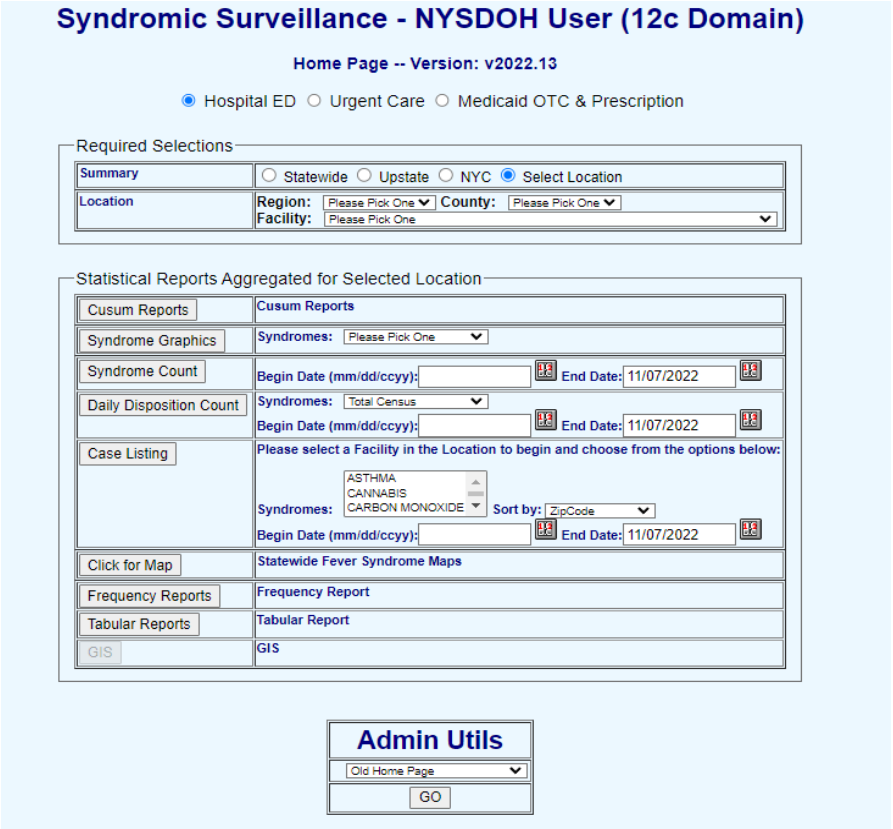
Abraham Ikejiofor, MPH, Charlene Weng, MS, Dina Hoefer, PhD

Electronic Syndromic Surveillance System
Bureau of Surveillance and Data Systems
Division of Epidemiology
New York State Department of Health

NYSDOH Electronic Syndromic Surveillance System (ESSS)

ESSS Home Page

- Hosted on the New York State Health Commerce System
  - https://commerce.health.state.ny.us/doh2/applinks/edsurv/SyndromicSurvHome
- Data from the previous day are submitted daily via Electronic Clinical Laboratory Reporting System (ECLRS), then categorized into 17 syndromes.
- Categorize visits from EDs into disease or illness syndromes, based on patient chief complaint and discharge diagnostic (CCDD) upon admission to ED.

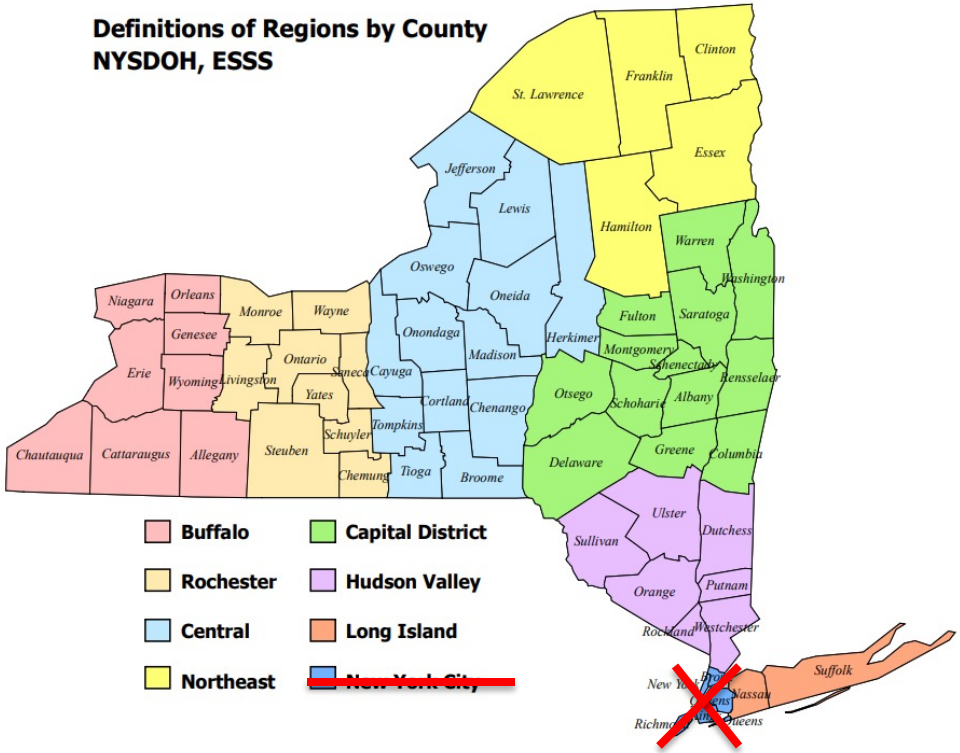


NEW YORK STATE Department of Health

Syndrome Definition and Categories

- **Syndrome Definition**
  - A set of signs and symptoms that appear together and characterize a disease or medical condition.

- **NYS ESSS ED Syndrome Categories:**
  - **Asthma**
  - **Cannabis**
  - **COVID-19**
  - **Carbon Monoxide**
  - **Drug overdose**
  - **Fever**
  - **GI**
  - **Heat**
  - **Heroin overdose**
  - **Hypothermia**
  - **Neurologic**
  - **Opioid overdose**
  - **Rash**
  - **Respiratory**
  - **Synthetic drugs**
  - **Stimulant**
  - **Suicide**



Regions and Coverage

134 Total Upstate NY EDs
133 EDs participate in ESSS

New York City Department of Health and Mental Hygiene (NYC DOHMH) has their own Syndromic Surveillance System for NYC EDs.

NEW YORK STATE Department of Health

Cannabis Syndrome Development

Cannabis Syndrome Background

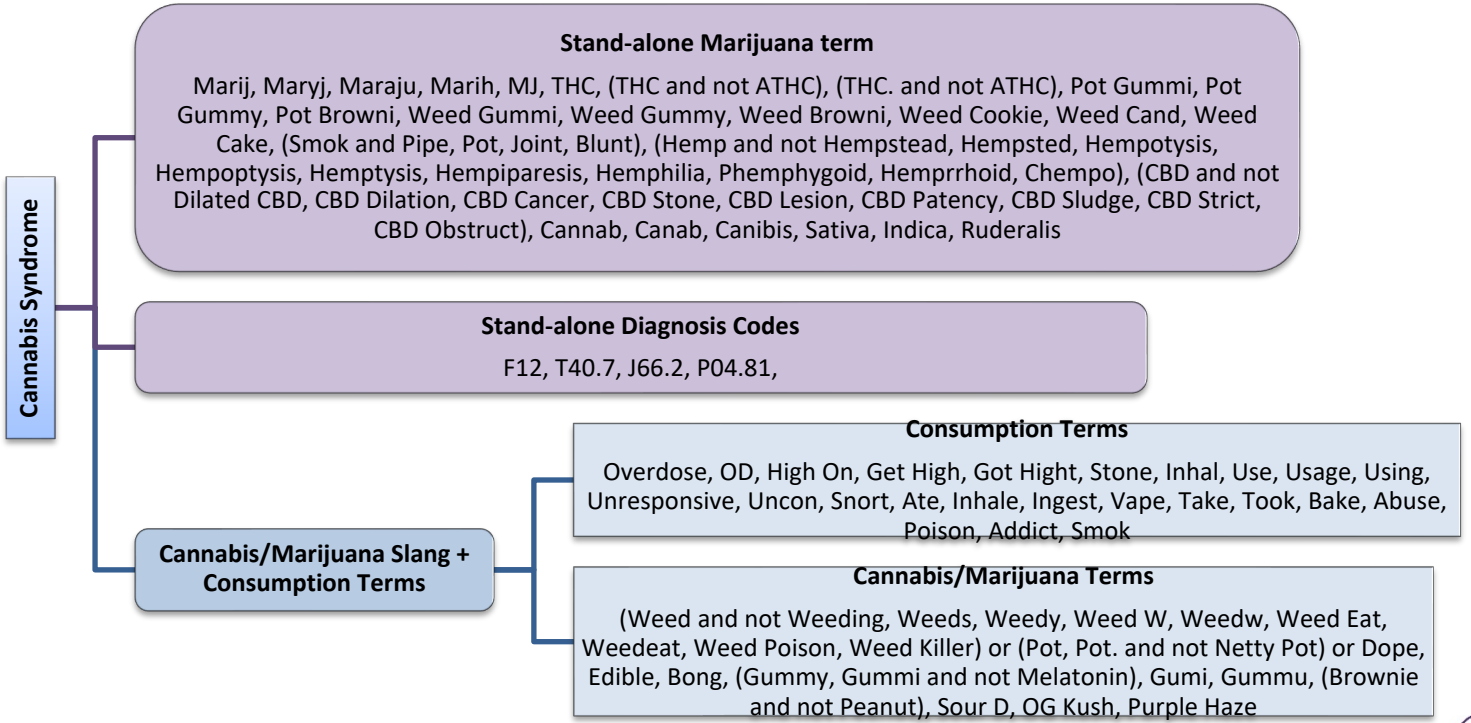
- On March 31, 2021, Marijuana Regulation & Taxation Act (MRTA) was signed into NYS law.
- The Cannabis Surveillance Plan (CSP).
- We were asked to develop a cannabis syndrome to monitor ED visits.
- NYS's cannabis surveillance aims to monitor ED visits under four categories:
  - Cannabis abuse and dependence
  - Cannabis use
  - Cannabis poisoning and adverse effects
  - Cannabinosis

Syndrome Development

A query was created by SAS software run against NYS hospital ED (excluding NYC EDs) patient chief complaints and ICD-10 codes to identify cannabis-related ED visits one year after its legalization.

SAS coding schema components
Component one: Free text in chief complaints such as 'Marijuana' or ICD-10 codes such as F12
Component two: Cannabis consumption term and cannabis slang term.
Component three: Exclude identified misclassifications

NYSDOH's Cannabis Syndrome Definition



NEW YORK STATE | Department of Health

Results & Conclusions

Results

- 24,466 ED visits were identified as cannabis-related visits from March 21, 2021, to March 21, 2022.
- ICD-10 codes alone picked up 23,237 (94%) of them, and cannabis related disorders (F12) accounted for 22,363 (91%).
- Chief complaints alone picked up 1,104 (5%).
- Overall, misclassifications were about less than 1%.

Cannabis Syndrome Filter Results

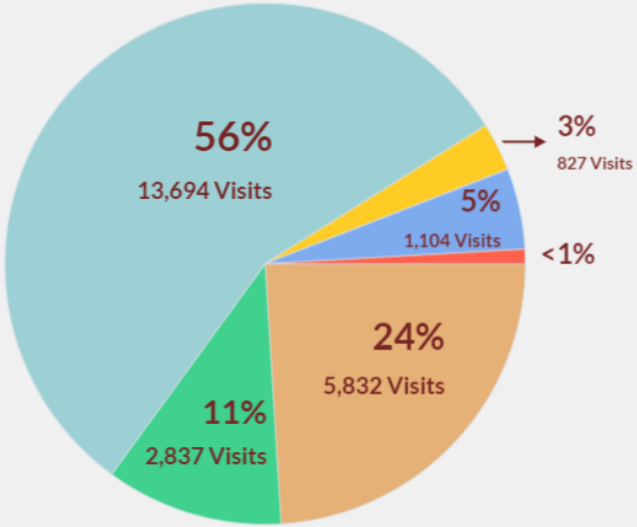
- ICD-10 code F12.9
- ICD-10 code F12.1
- ICD-10 code F12.2
- Chief Complaints Only
- ICD-10 code T40.7
- Misclassifications
- ICD-10 code J66.2

Total Visits: 24,466

Code J66.2 is too small to be visible

Filter results from March 21, 2021, to March 21, 2022.

IN PERCENTAGE



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Conclusions

- Cannabis related disorders were the main reason for a cannabis-related ED visit, among which unspecified cannabis use, cannabis abuse, and cannabis dependency were the top three reasons.

- ICD-10 codes identified majority of related ED visits.

- Identifying potential misclassifications can be improved.

Future Steps

- Expand the data in comparison to prior years.
- Further stratification of cannabis data breakdown by demographics such as gender, age groups, race, ethnicity, etc.
- Stratify cannabis data on 1) cannabis abuse and dependence, 2) cannabis use, and 3) cannabis poisoning and adverse effects.

Thank you!

For questions or additional information please email SyndSurv@health.ny.gov

Stephanie Neal, MPH
Virginia Department of Health

CSTE

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In the Weeds with Definition Validation: Creating a Virginia Specific Stimulant Overdose Definition

Stephanie Neal, MPH

Virginia Department of Health

VDH VIRGINIA DEPARTMENT OF HEALTH

To protect the health and promote the well-being of all people in Virginia.

OBJECTIVES

- Explain the importance of validating syndrome definitions before use in individual sites

- Describe four main issues that occurred during validation of CDC Stimulant v3 in Virginia ESSENCE and how they were resolved

Background

- Cocaine-involved and methamphetamine-involved fatal overdoses increased by 24% and 42%, respectively, in 2021 compared to previous years

- Existing CDC Stimulant v3 definition used for OD2A data submission in NSSP ESSENCE

- VDH sought to validate the CDC stimulant v3 overdose definition in Virginia ESSENCE for use in monthly reporting

Why Validate?

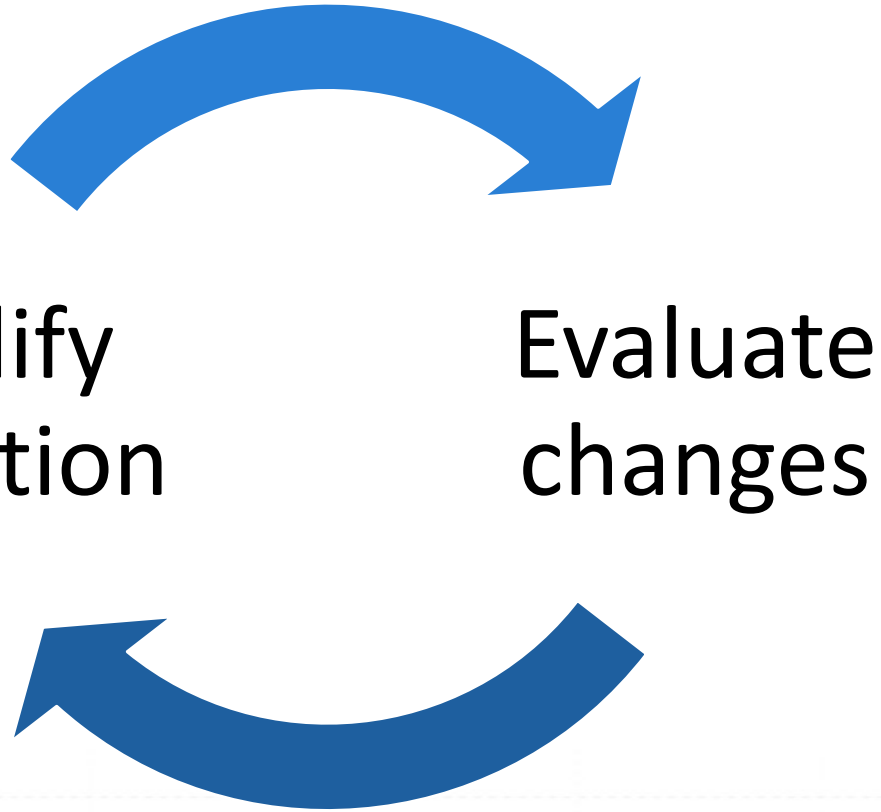
- CDC definitions may perform differently in local instances of ESSENCE
  - Virginia ESSENCE includes discharge diagnosis description in DD and CCDD fields

CDC Stimulant v3, 2021	
NSSP ESSENCE	Virginia ESSENCE
573 visits	2,907 visits

- Local or health system coding and reporting practices may affect how definitions perform for certain geographic areas
  - Virginia data includes SNOMED diagnosis codes

Process

1. Manually reviewed visits pulled by CDC definition
2. Reviewed stimulant diagnosis codes
3. Compared definition key terms with clinical signs/symptoms of stimulant overdose



Manual Review Revealed False Positives

- Visits with stimulant use or abuse, not necessarily overdose

ALCOHOL |

F10.920;Alcohol use, unspecified with **intoxic**ation, uncomplicated;F14.10;**Cocaine** abuse, uncomplicated;

- Self-harm or suicide related visits

SUICIDAL IDEATION CHEST PAIN **POISON**ING BY SALICYLATES ACCIDENTAL UNINTENTIONAL INITIAL ENCOUNTER |

F12.20;Cannabis dependence, uncomplicated;F10.20;Alcohol dependence, uncomplicated;F14.20;**Cocaine** dependence, uncomplicated;

- Visits not related to stimulant use

OVERDOSE EXLAX |

T47.2X1A;**POISON**ING BY **STIMULANT** LAXATIVES, ACCIDENTAL, INIT;

Summary of Issues

1) Incomplete diagnosis codes

2) Presence of non-overdose stimulant use/abuse/dependence visits

3) Intentional self-harm and suicide visits not excluded

4) Key terms and syntax updates

Issue #1 – Updating Diagnosis Codes

- Reviewed 52 diagnosis codes (ICD9, ICD10, SNOMED)
  - Added or removed from definition based on 1) presence in data from January-July 2021; and 2) whether codes captured stimulant overdoses
- Removed 2 codes
  - E855.2 - accidental poisoning by local anesthetics
  - 441527004 - stimulant abuse
- Added 12 SNOMED codes
  - Poisoning/intoxication/accidental poisoning/accidental overdose by cocaine, crack, psychostimulant, amphetamine, or caffeine
  - 27956007, 9982009, 20260003, 45421006, 241761001, 57005003, 296325008, 296317006, 296291005, 45775001, 296329002, and 296330007

Issue #2 – Use/Abuse/Dependence codes

- Visits pulled because of stimulant/cocaine use/abuse/dependence code descriptions
  - VA ESSENCE includes text in discharge diagnosis fields
  - Presence not necessarily an indicator of overdose
- Several options to negate visits but the final syntax included:
  - **(,(,^coc[ai][ia]ne^,or,^stimulant^,),andnot,(,^f1[45].[129][0134589]^,or,^f1[45][129][0134589**
  - **,(,(,^verdo[se][es]^,or,^over dose^,or,^overose^,),and,(,^f1[45].[129]2^,or,^f1[45][129]2^,),)**

Issue #3 – Intentional Self-Harm and Suicide Visits

- Not excluded in CDC Stimulant v3

- Standard negations for all VDH overdose definitions

,(,^denie[ds] drug^,or,^deny drug^,or,^denying drug^,or,^denies any drug^,or,^ with dra ^,or,^withdra^,or,^detoxification^,or,^detos^,or,^detoz^,or,^dtox^,or,^ cardiac-stimulant^,or,^cardiac stimulant^,or,^T47.2X1A^,or,^T472X1A^,or,^suicid^,or,^sucidi^,or,^suicial^,or,intentional^,or,^[;/]intentional^,or,^on purpose^,or,(,^self^,and,^harm^,),or,^V6284^,or,^V62.84^,or,^E9[567]^,or,^R45.851^,or,^R45851^,)

Key Term Comparison

- Stimulant overdoses may present differently from opioid overdose
- Some clinical signs and symptoms of stimulant overdose not included in CDC definition
  - Cardiovascular – tachycardia, arrhythmia, chest pain, stroke
  - Psychological – paranoia, anxiety
- Adding these terms led to false positives
- Provided feedback to CDC
  - Cardiovascular terms were added to CDC Cocaine Overdose definition

Issue #4 – Key terms and Syntax

- Did not add new terms (e.g. tachycardia) due to overlap with other conditions
- Cleaned up/streamlined the definition
  - ^ meth ^ to !meth! and ^ crack ^ to !crack!
  - Restructured negations to be next to each term rather than a blanket list
  - Changed ^denies drug^,or,^deny drug^,or,^denied drug^ to ^denie[ds] drug^,or,^deny drug^
  - Removed ^dextroamphetamine^ and ^levoamphetamine^ because they are captured by ^amphetamine^
  - Added alcohol as negation to ^intoxic^
- Removed negations not seen in Virginia data since 2017

Final VDH Stimulant Definition

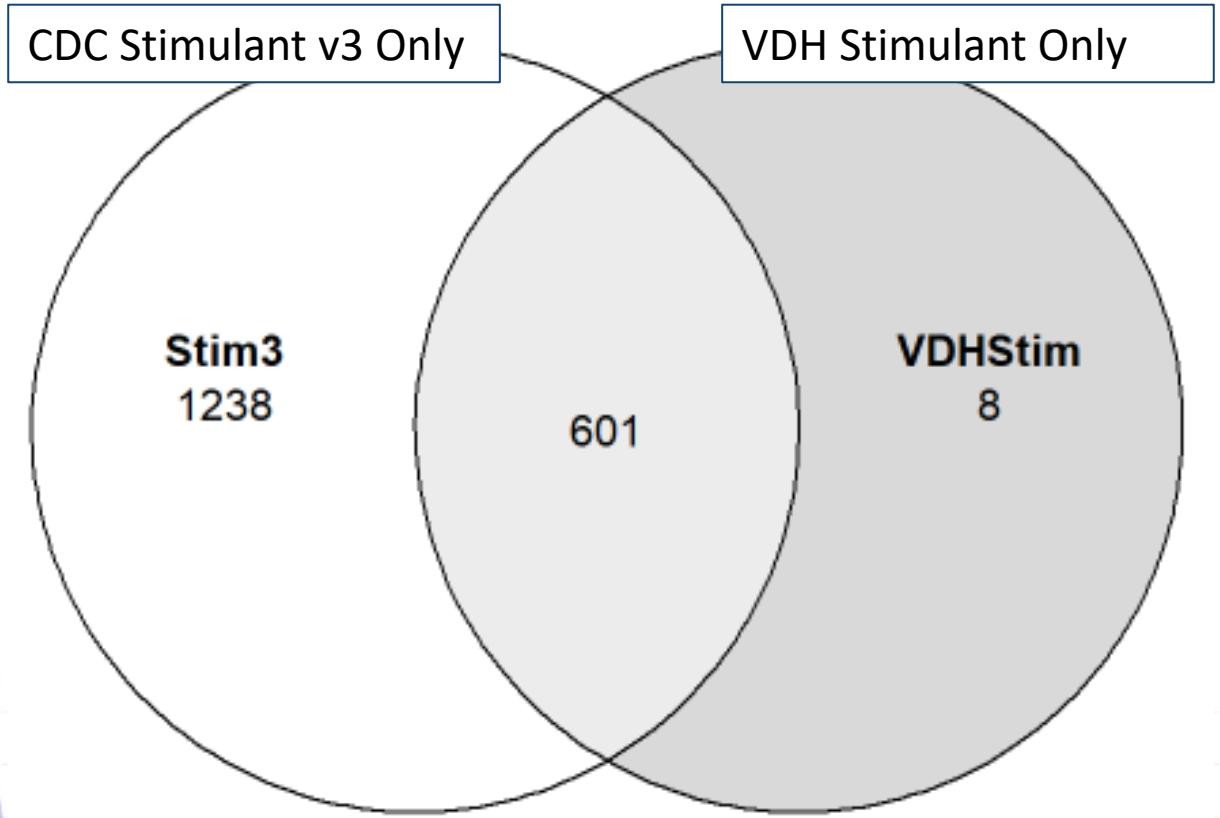
Discharge Diagnosis portion: ICD-9, ICD-10, and SNOMED codes (auto inclusion)

Chief Complaint portion: overdose related terms and stimulant terms andnot withdrawal/detox terms or stimulant laxative code or suicide/self-harm terms/codes

(,^969.7[01239][;/]^,or,^9697[01239][;/]^,or,^970.[09]^,or,^970[09][;/]^,or,^970.8[19][;/]^,or,^9708[19][;/]^,or,^E854.[23][;/]^,or,^E854[23]^,or,^T40.5X[14]A^,or,^T405X[14]A^,or,^T43.6[012349][14]A^,or,^T436[012349][14]A^,or,^296321004^,or,^9982009^,or,^27956007^,or,^296325008^,or,^241761001^,or,^296317006^,or,^20260003^,or,^296290006^,or,^61803000^,or,^296291005^,or,^45775001^,or,^45421006^,or,^296329002^,or,^296330007^,or,^57005003^,),or,(,(,(,^poison^,or,^verdo[se][es]^,or,^over dose^,or,^overose^,or,^nodding^,or,^ nod ^,or,^snort^,or,^in[gj]est^,or,^intoxic^,andnot,(,^alc[oh]^,),or,^unresponsiv^,or,^loss of conscious^,andnot,(,^no loss of conscious^,or,^denie[sd] loss of conscious^,or,^negative loss of conscious^,or,^denies any loss of conscious^,or,^without loss of consci^,),or,^syncop^,or,^shortness of breath^,or,^short of breath^,or,^altered mental status^,),and,(,^speedball^,or,^speed ball^,or,(,!meth!,),or,^c[ry][yr]stal meth^,or,^amphetamine^,or,^lisdexamfetamine^,or,^biphetamine^,or,^dexedrine^,or,^adderal^,or,^aderal^,or,^vyvanse^,or,^concerta^,or,^methylin^,or,^ritalin^,or,^cathinone^,or,^bathsalt^,or,^bath salt^,or,^ MDMA ^,or,^e[sc][cs]ta[cs]y^,or,^e[xsc]ta[sc]y^,or,^ex[sc]ta[sc]y^,or,^ moly ^,or,^ moll[iy] ^,or,(,(,^coc[ai][ia]ne^,or,^stimulant^,),andnot,(,^f1[45].[129][0134589]^,or,^f1[45][129][0134589]^,),),or,^cocc[ai][ia]ne^,or,^cocane^,or,^cocanne^,or,^coke^,andnot,(,^diet coke^,or,^coke zero^,or,^drink a coke^,or,^coke can^,),or,(,!crack!,),andnot,(,^a crack^,or,^crack in^,or,^knee crack^,or,^shoulder crack^,or,^butt crack^,or,^ankle crack^,or,^callous crack^,or,^pop crack^,or,^loud crack^,or,^it crack^,or,^heard crack^,or,^felt crack^,or,(,^rib^,and,^crack^,),or,^snap crack^,or,^growth plate^,or,^crack sidewalk^,or,^t[oe][oe]th^,or,^heard something^,or,^nail^,or,^crack area^,or,^back crack^,or,^crack of^,or,^crack his^,or,(,^lip^,and,^crack^,),or,^my crack^,or,(,^buttock^,and,^crack^,),or,^crack on ^,or,^crack to ^,or,^foot crack^,),or,(,(,^verdo[se][es]^,or,^over dose^,or,^overose^,),and,(,^f1[45].[129]2^,or,^f1[45][129]2^,),),),),andnot,(,^denie[ds] drug^,or,^deny drug^,or,^denying drug^,or,^denies any drug^,or,^ with dra ^,or,^withdra^,or,^detoxification^,or,^detos^,or,^detoz^,or,^dtox^,or,^ cardiac-stimulant^,or,^cardiac stimulant^,or,^T47.2X1A^,or,^T472X1A^,or,^suicid^,or,^sucidi^,or,^suicial^,or,intentional^,or,^[;/]intentional^,or,^on purpose^,or,(,^self^,and,^harm^,),or,^V6284^,or,^V62.84^,or,^E9[567]^,or,^R45.851^,or,^R45851^,),)

Results - CDC vs Final VDH Definition

- 1,839 visits pulled by CDC Stimulant v3 definition Jan-Jul 2021
- PPV increased from 37% to 54%
- Of the 1238 false positives not included in the VDH definition
  - 93% (n=1153) non-overdose related stimulant/cocaine use/abuse/dependence
  - 5% (n=60) self-harm suicide
  - 2% (n=25) other reasons



LIMITATIONS

- Did not validate against external data source (e.g. medical record), could not determine definition sensitivity

- True stimulant overdoses possibly missed by not adding cardiovascular and psychological key terms to definition

Conclusion

- Validation and modification of CDC Stimulant v3 definition was an iterative process that resulted in a Virginia specific definition
- Important to validate definitions with state specific data prior to use at the state/local level
- Incorporated stimulant overdose data into monthly and quarterly reports

QUESTIONS?

Contact Information

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VDH Drug Overdose Surveillance page

Special Thanks to

- Meredith Davis, MPH
- Sara Chronister, MPH

Nina Masters, PhD
CDC

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Revising the CDC Chickenpox query for improved case, outbreak, and time-trend detection

2022 Syndromic Surveillance Symposium
Breakout Session: The Pursuit of Validation, December 7, 2022

Nina Masters, PhD, MPH
Division of Viral Diseases, National Center for Immunization and Respiratory Diseases

- Varicella (chickenpox) is a highly contagious febrile rash illness caused by varicella-zoster virus (VZV)

- VZV remains latent in nerve tissue; reactivating to later cause herpes zoster

- In the United States, before the varicella vaccine, there were an annual:
  - ~4 million estimated cases
  - 10 – 13k hospitalizations
  - 100 – 150 deaths

- Since the varicella vaccine was introduced in 1995, incidence has **declined 97.4%**

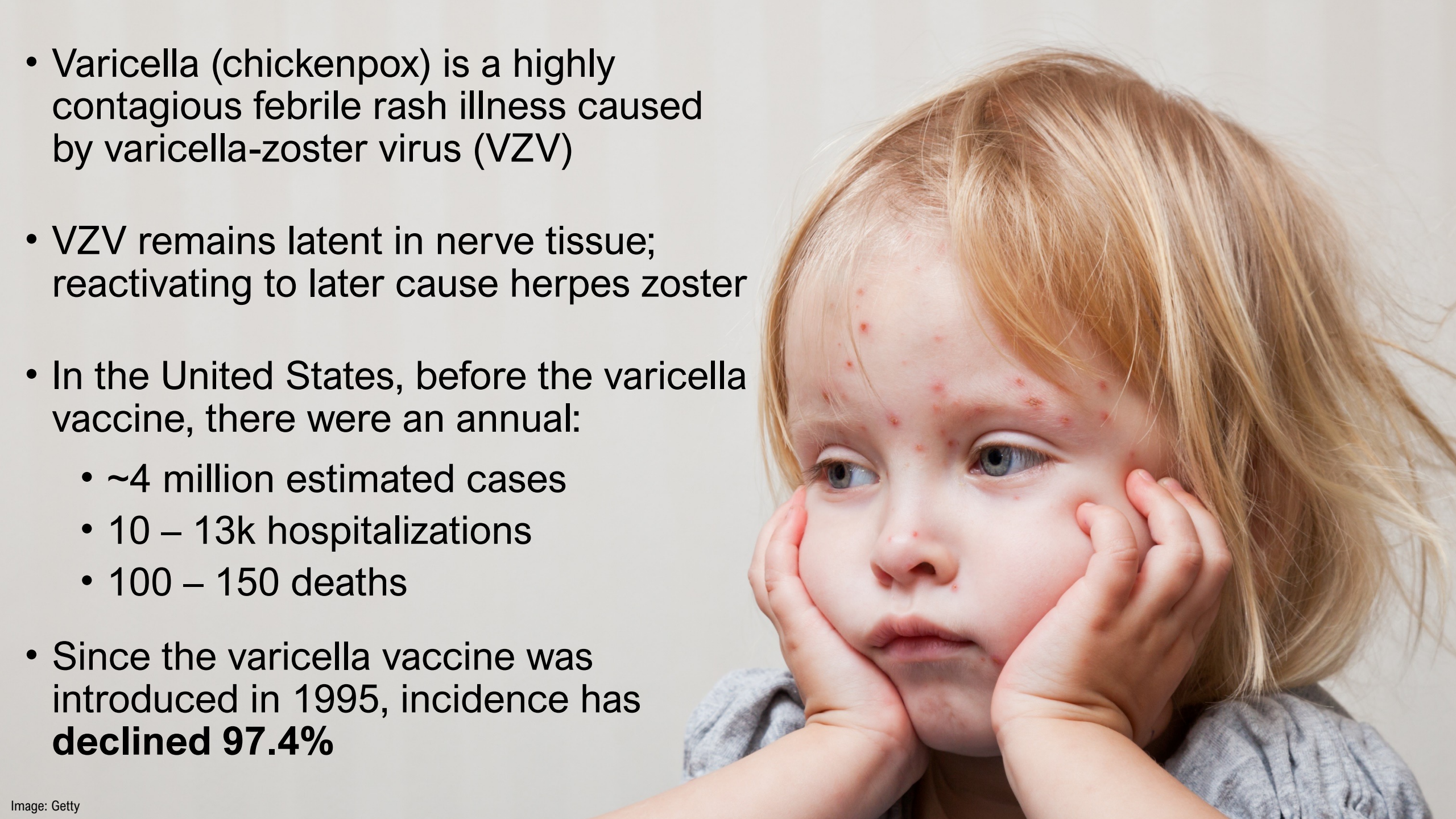
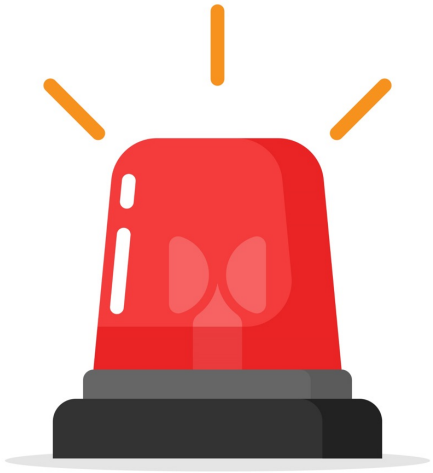


Image: Getty

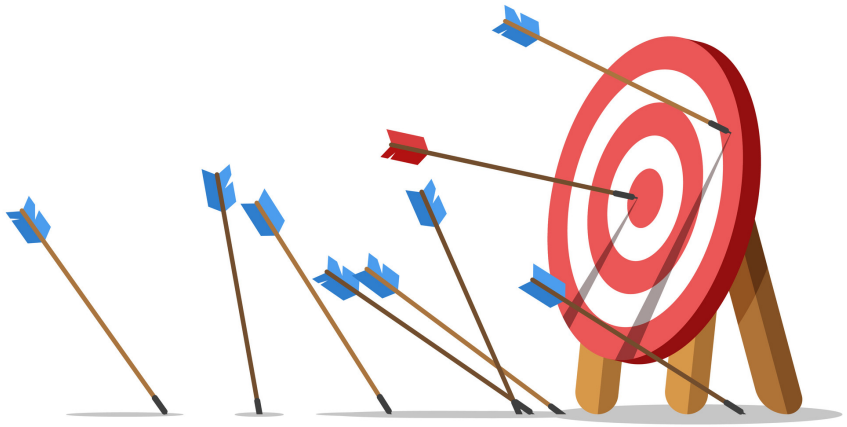
Varicella surveillance is necessary, but imperfect

Surveillance is critical to monitor the impact of the vaccination program



Varicella is a **nationally notifiable disease in the US;** States encouraged to report to NNDSS

39 states conduct case-based varicella surveillance (as of 2020)



There is **no gold standard** for varicella surveillance; frequent under-reporting

CDC Chickenpox v2 Query Validation Project Timeline

Part 1: Query Exploration for EIS Surveillance Evaluation

August 2021

- Preliminary meetings
- Access to ESSENCE
- Level setting/ understanding expectations

Sept 2021

- Began qualitative & quantitative assessment of query performance
- Met with NSSP team to understand query history

Oct 2021

- Assessed that query was very non-specific included visits for HZ, VZV testing, routine visits
- Met to suggest changes to increase specificit y

Nov 2021

- Specify query goals with CDC varicella program
- Develop action plan for query validation with state and local health departments

Part 2: Query Validation with Participating Jurisdictions

April 2022

- Present to syndrome development call
- 6 jurisdictions interested in participating in pilot
- Initial meeting to discuss surveillance and experience with v1

May 2022

- Revise and begin to pilot test modified query
- Discuss query output and utility
- Propose v2 query

June 2022

- Test proposed v2 query
- Revise v2 query
- Compare v2 query performance to v1

July 2022

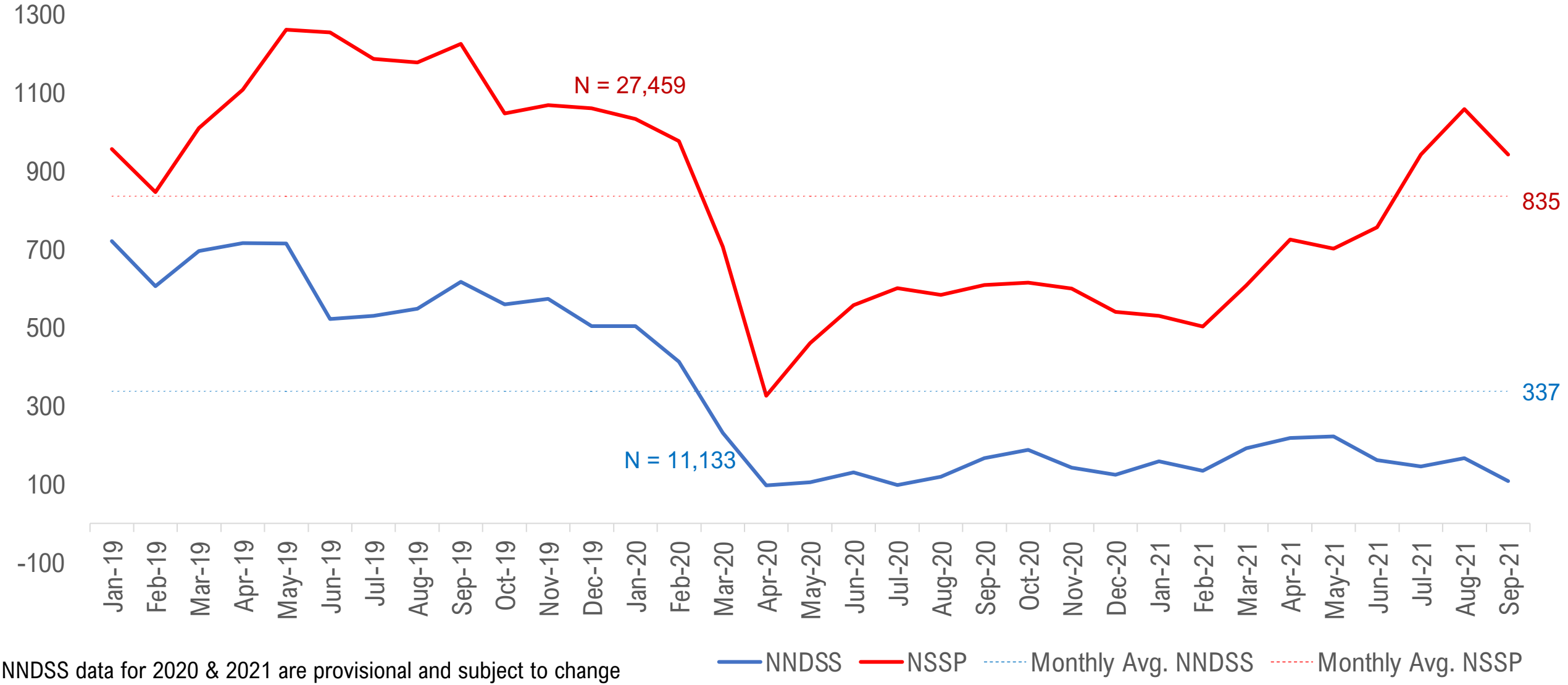
- Finalize v2 query by July 1
- Submit to DHIS to incorporate into ESSENCE

A Quick look at the ‘CDC Chickenpox Query v1’ Definition

(,(,^chickenpox^,or,^chicken pox^,or,^varicella^,or,^pocks^,or,^chik_po^,),or,^[;/]B01^,or,(,^[;/]Z20.820^,or,^[;/]Z20820^,or,^[;/]24059009^,or,^[;/]402899000^,or,^[;/]90433002^,or,^[;/]277644009^,or,^[;/]715223009^,or,^[;/]713250002^,or,^[;/]31920006^,or,^[;/]432721000124102^,or,^[;/]428591000124108^,or,^[;/]240468001^,or,^[;/]240469009^,or,^[;/]38907003^,or,^[;/]186508005^,or,^[;/]154325003^,or,^[;/]192732000^,or,^[;/]186513009^,or,^[;/]186511006^,or,^[;/]186512004^,or,^[;/]416718008^,or,^[;/]309465005^,or,^[;/]187419000^,or,^[;/]187420006^,or,^[;/]186509002^,or,^[;/]195911009^,or,^[;/]410509003^,or,^[;/]19551004^,or,^[;/]80298008^,or,^[;/]186510007^,or,^[;/]23737006^,or,^[;/]111858004^,),),),

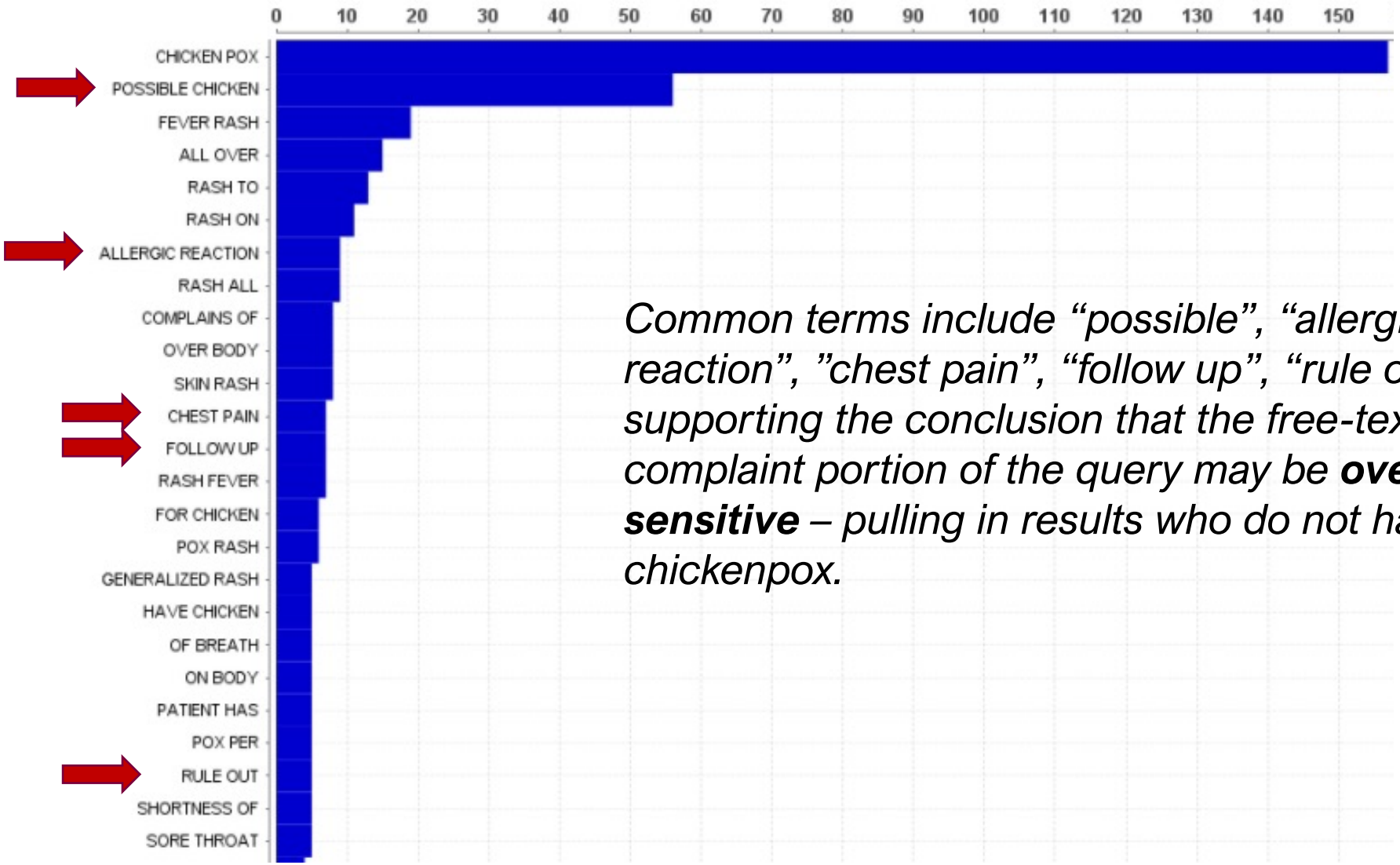
ANDNOT,(,^vaccin^,or,^prophyla^,or,^inocu^,or,^shingles^,or,^shot^,or,^immunization^,or,^inject^,or,^meningitis^,or,^titer^,or,^[;/]Z23^,or,^[;/]Z20.828^,or,^[;/]Z20828^,or,^[;/]Z00129^,or,^[;/]Z00.129^,or,^[;/]138696001^,or,^[;/]161423008^,or,^[;/]444453009^,or,^[;/]10491005^,or,^[;/]147732005^,or,^[;/]432636005^,or,^[;/]433733003^,or,^[;/]116813009^,or,^[;/]451331000124106^,or,^[;/]333768004^,or,^[;/]425897001^,or,^[;/]473164004^,or,^[;/]710704003^,or,^[;/]116868008^,or,^[;/]419550004^,or,^[;/]419771007^,or,^[;/]104326007^,or,^[;/]703344003^,or,^[;/]428502009^,or,^[;/]390755008^,or,^[;/]371113008^,or,^[;/]371108009^,or,^[;/]413117001^,or,^[;/]68525005^,or,^[;/]6031000175102^,or,^[;/]122248009^,or,^[;/]122202000^,or,^[;/]121197005^,or,^[;/]122306004^,or,^[;/]122293001^,or,^[;/]116814003^,or,^[;/]412530002^,or,^[;/]412529007^,or,^[;/]108729007^,or,^[;/]396442000^,or,^[;/]377005004^,or,^[;/]377008002^,or,^[;/]366846003^,or,^[;/]166226001^,or,^[;/]395187004^,or,^[;/]392854005^,or,^[;/]703486008^,or,^[;/]134451006^,or,^[;/]165975001^,or,^[;/]62294009^,or,^[;/]421804006^,or,^[;/]333775003^,or,^[;/]333771007^,or,^[;/]293103002^,or,^[;/]294639003^,or,^[;/]407746005^,or,^[;/]407933006^,or,^[;/]424778000^,or,^[;/]398503008^,or,^[;/]407737004^,or,^[;/]259858000^,or,^[;/]313587003^,or,^[;/]315231005^,or,^[;/]260214004^,or,^[;/]252349000^,or,^[;/]120729003^,or,^[;/]122141009^,or,^[;/]121005009^,or,^[;/]445133005^,or,^[;/]366768003^,or,^[;/]143590001^,or,^[;/]143362001^,or,^[;/]413138007^,or,^[;/]122202000^,or,^[;/]121197005^,or,^[;/]122306004^,or,^[;/]122293001^,or,^[;/]116814003^,or,^[;/]412530002^,or,^[;/]412529007^,or,^[;/]108729007^,or,^[;/]396442000^,or,^[;/]377005004^,or,^[;/]377008002^,or,^[;/]366846003^,or,^[;/]166226001^,or,^[;/]395187004^,or,^[;/]392854005^,or,^[;/]703486008^,)

From 1/2019 – 9/2021, **NSSP** (varicella syndrome query v1) counts were ~2.5x **NNDSS** (case-based surveillance) counts



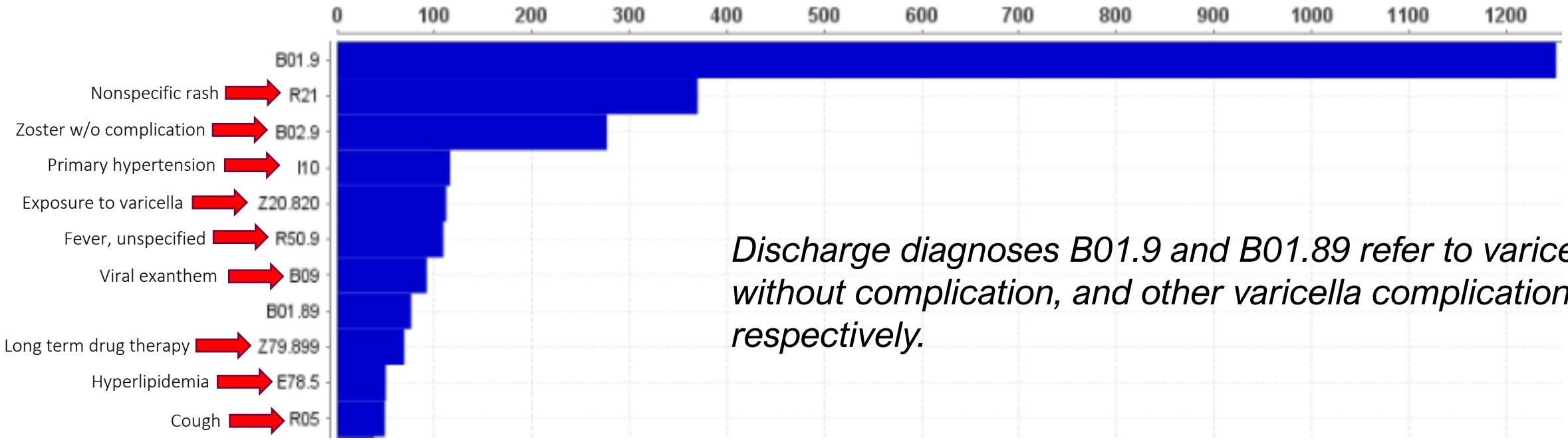
NNDSS data for 2020 & 2021 are provisional and subject to change

Chief-complaint analysis suggests v1 query is overly sensitive



*Common terms include "possible", "allergic reaction", "chest pain", "follow up", "rule out" – supporting the conclusion that the free-text chief complaint portion of the query may be **overly sensitive** – pulling in results who do not have chickenpox.*

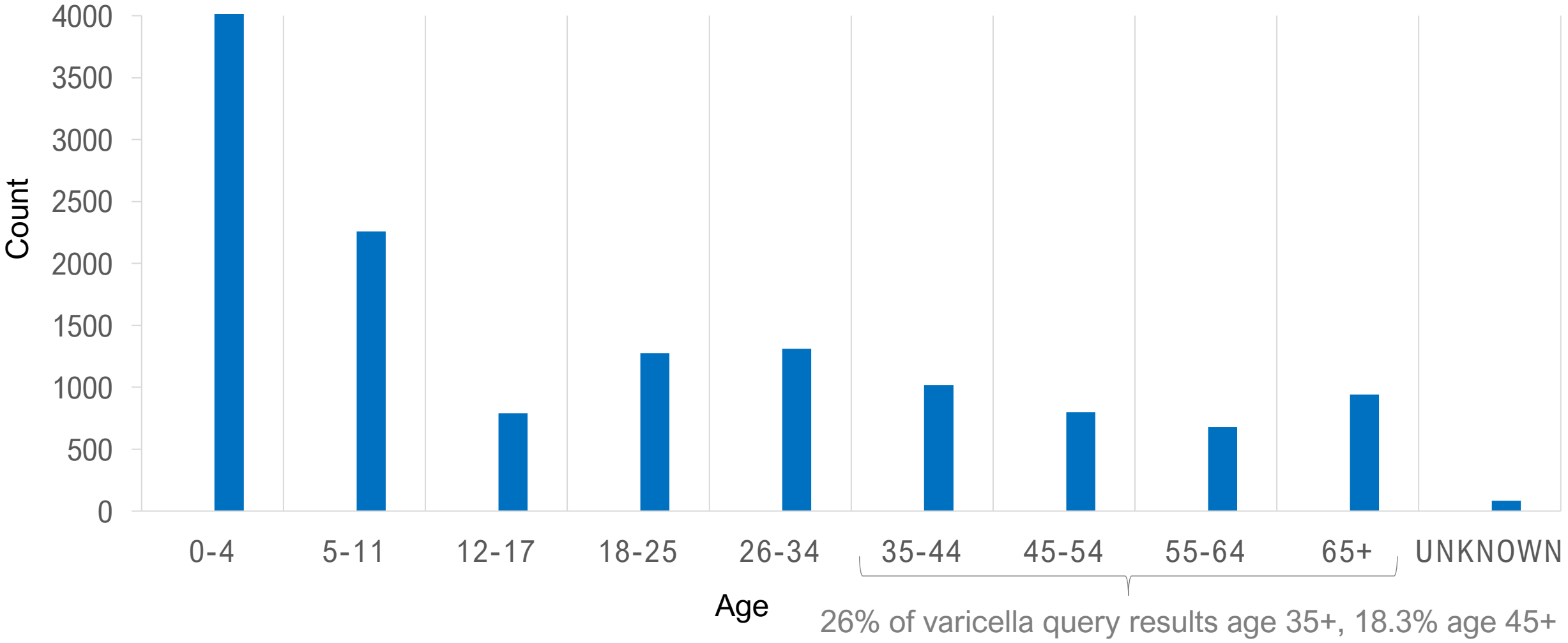
Discharge diagnosis analysis suggests v1 query is non-specific



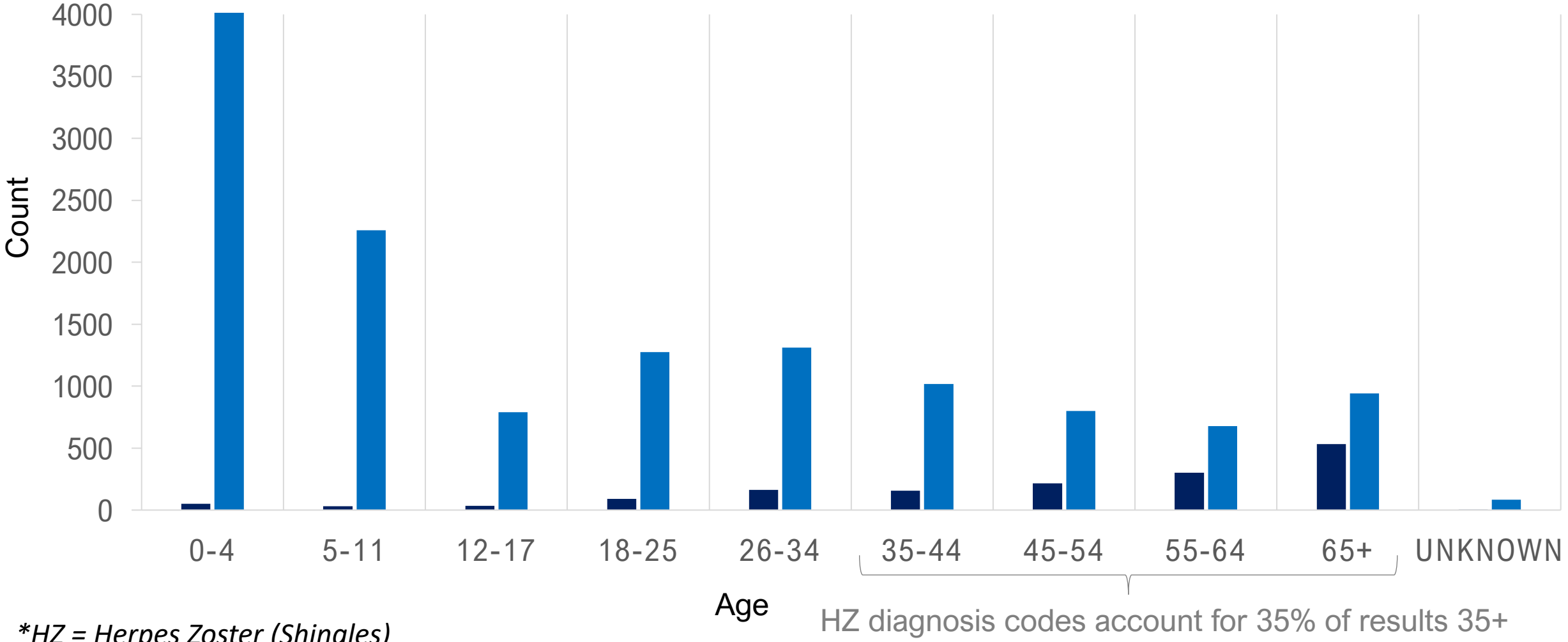
Discharge diagnoses B01.9 and B01.89 refer to varicella without complication, and other varicella complications, respectively.

Other top discharge codes support the conclusion that the query is non-specific: top diagnosis codes include R21 (nonspecific rash), B02.9 (Zoster), I10 (Hypertension), Z20.820 (Exposure to Varicella), and R50.9 (Fever, unspecified).

v1 syndrome query results (n = 13,198) from 2019 showed a surprising age distribution, with 1 in 4 cases over age 35



Comparing **v1 syndrome results** (n = 13,198) **with results with an ICD10 code for HZ*** (n=1,573) showed HZ accounted for 35% of query results over age 35, and 43% of results over age 45



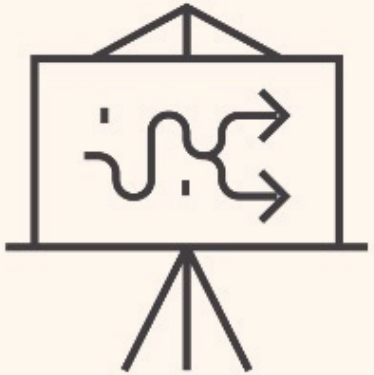
*HZ = Herpes Zoster (Shingles)

Goals for a v2 query: increased specificity, sensitivity, & efficiency

Increase specificity & representativeness

Remove inappropriate inclusion terms; add exclusion terms for herpes zoster (HZ)

Increase sensitivity



Restructure the logic of the query

Increase computational efficiency

Declutter the query by removing retired, never used codes

Work with 6 jurisdictions to validate the v2 query began in 2022

(,(,^chickenpox^,or,^chicken pox^,or,^varicella^,~~or,^pocks^,or,^chik_po^,~~),or,^[;/]B01^,or,(,^[;/]Z20.820^,or,^[;/]Z20820^,or,^[;/]24059009^,~~or,^[;/]402899000^~~,or,^[;/]90433002^,or,^[;/]277644009^,or,^[;/]715223009^,~~or,^[;/]713250002^~~,or,^[;/]31920006^,or,^[;/]432721000124102^,or,^[;/]428591000124108^,or,^[;/]240468001^,or,^[;/]240469009^,or,^[;/]38907003^,~~or,^[;/]186508005^,or,^[;/]154325003^,or,^[;/]192732000^,or,^[;/]186513009^,or,^[;/]186511006^,or,^[;/]186512004^~~,or,^[;/]416718008^,or,^[;/]309465005^,~~or,^[;/]187419000^,or,^[;/]187420006^~~,or,^[;/]186509002^,or,^[;/]195911009^,~~or,^[;/]410509003^,or,^[;/]19551004^,or,^[;/]80298008^,or,^[;/]186510007^~~,or,^[;/]23737006^,~~or,^[;/]111858004^~~,),), ANDNOT(,^vax^, or,
^vaccin^,or,^prophyla^,or,^inocu^,or,^shingles^,or,^zoster^,or,^shot^,or,^immunization^,or,^inject^,~~or,^meningitis^~~,or,^titer^, or,^[;/]B02^, or,^[;/]Z11.59^, or, ^[;/]T50.B95A^, or,^[;/]Z23^,or,~~^[;/]Z20.828^,or,^[;/]Z20828^~~,or, ^[;/]Z00129^,or,^[;/]Z00.129^,~~or,^[;/]138696001^~~,or,^[;/]161423008^,or,^[;/]444453009^,or,^[;/]10491005^,~~or,^[;/]147732005^,or,^[;/]432636005^,or,^[;/]433733003^~~,or,^[;/]116813009^,or,^[;/]451331000124106^,~~or,^[;/]333768004^~~,or,^[;/]425897001^,~~or,^[;/]473164004^,or,^[;/]710704003^~~,or,^[;/]116868008^,or,^[;/]419550004^,or,^[;/]419771007^,or,^[;/]104326007^,or,^[;/]703344003^,or,^[;/]428502009^,or,^[;/]390755008^,or,^[;/]371113008^,or,^[;/]371108009^,or,^[;/]413117001^,~~or,^[;/]68525005^~~,or,^[;/]6031000175102^,~~or,^[;/]122248009^,or,^[;/]122202000^,or,^[;/]121197005^,or,^[;/]122306004^,or,^[;/]122293001^~~,or,^[;/]116814003^,or,^[;/]412530002^,or,^[;/]412529007^,or,^[;/]108729007^,or,^[;/]396442000^,~~or,^[;/]377005004^,or,^[;/]377008002^,or,^[;/]366846003^,or,^[;/]166226001^,or,^[;/]395187004^,or,^[;/]392854005^~~,or,^[;/]703486008^,or,^[;/]134451006^,~~or,^[;/]165975001^~~,or,^[;/]62294009^,~~or,^[;/]421804006^~~,or,^[;/]333775003^,or,^[;/]333771007^,or,^[;/]293103002^,or,^[;/]294639003^,or,^[;/]407746005^,or,^[;/]~~407933006^,or,^[;/]424778000^,or,^[;/]398503008^~~,or,^[;/]407737004^,or,^[;/]259858000^,or,^[;/]313587003^,~~or,^[;/]315231005^,or,^[;/]260214004^~~,or,^[;/]252349000^,~~or,^[;/]120729003^,or,^[;/]122141009^,or,^[;/]121005009^,or,^[;/]445133005^,or,^[;/]366768003^,or,^[;/]143590001^,or,^[;/]143362001^,or,^[;/]413138007^~~,or,^[;/]122202000^,or,^[;/]121197005^,or,^[;/]122306004^,or,^[;/]122293001^,or,^[;/]116814003^,or,^[;/]412530002^,or,^[;/]412529007^,or,^[;/]108729007^,or,^[;/]396442000^,or,^[;/]377005004^,or,^[;/]377008002^,or,^[;/]366846003^,or,^[;/]166226001^,or,^[;/]395187004^,or,^[;/]392854005^,or,^[;/]703486008^,) or,^[;/]410509003^,

Key:

- duplicate terms
- retired SNOMED codes/never used
- inclusion term that should be removed based on SME feedback
- negation term that should be removed based on SME feedback
- Restructure logic so that these codes only pull in records if they are ALSO symptomatic
  Look more into these codes for maternal infection – are these double counting?
- Remove from inclusion, move to negation
- Investigate whether if we remove well child visits, we get a lot more false +
- Newly added exclusion terms

Final v2 query syntax

(,^[;/]B01^,ANDNOT,(,^[;/]B02^,OR,^[;/]Z00129^,OR,^[;/]Z00.129^,OR,^vax^,OR,^vaccin^,OR,^follow up^,OR,^shot^,OR,^immunization^,OR,^annual^,OR,^rtn^,OR,^screening^,OR,^well child^,OR,^well woman^,OR,^return^,OR,^physical^,),),OR,(,(,(,^chickenpox^,OR,^chicken pox^,OR,^varicella^,),OR,(,(^[;/]Z20.820^,OR,^[;/]Z20820^),AND,(,^rash^,OR,^fever^,OR,^[;/]R21^,OR,^[;/]R50^,),),OR,(,^[;/]24059009^,OR,^[;/]90433002^,OR,^[;/]277644009^,OR,^[;/]715223009^,OR,^[;/]31920006^,OR,^[;/]4327210000124102^,OR,^[;/]42859100012410 8^,OR,^[;/]240468001^,OR,^[;/]240469009^,OR,^[;/]38907003^,OR,^[;/]416718008^,OR,^[;/]309465005^,OR,^[;/]186509002^,OR,^[;/]195911009^,OR,^[;/]23737006^,),),ANDNOT,(,^vax^,OR,^vaccin^,OR,^prophyla^,OR,^inocu^,OR,^shingles^,OR,^zoster^,OR,^shot^,OR,^immunization^,OR,^inject^,OR,^titer^,OR,^labs^,OR,^RTN^,OR,^Specimen Collection^,OR,^titre^,OR,^titter^,OR,^antibody^,OR,^MMR^,OR,^PPD Lab for Varicella immunity^,OR,^follow up^,OR,^screening^,OR,^annual^,OR,^well child^,OR,^well woman^,OR,^return^,OR,^Rule out^,OR,^bite^,OR,^physical^,OR,^[;/]B02^,OR,^[;/]Z1159^,OR,^[;/]Z11.59^,OR,^[;/]Z111^,OR,^[;/]Z11.1^,OR,^[;/]Z0184^,OR,^[;/]Z01.84^,OR,^[;/]B08.4^,OR,^[;/]B084^,OR,^[;/]B08.1^,OR,^[;/]B081^,OR,^[;/]Z02.89^,OR,^[;/]Z0289^,OR,^[;/]L42^,OR,^[;/]T50B95A^,OR,^[;/]T50.B95A^,OR,^[;/]Z23^,OR,^[;/]Z00129^,OR,^[;/]Z00.129^,OR,^[;/]116813009^,OR,^[;/]45133100012410 6^,OR,^[;/]425897001^,OR,^[;/]116868008^,OR,^[;/]419550004^,OR,^[;/]419771007^,OR,^[;/]104326007^,OR,^[;/]703344003^,OR,^[;/]428502009^,OR,^[;/]390755008^,OR,^[;/]371113008^,OR,^[;/]371108009^,OR,^[;/]413117001^,OR,^[;/]60310001751 02^,OR,^[;/]116814003^,OR,^[;/]412530002^,OR,^[;/]412529007^,OR,^[;/]108729007^,OR,^[;/]396442000^,OR,^[;/]703486008^,OR,^[;/]134451006^,OR,^[;/]62294009^,OR,^[;/]333775003^,OR,^[;/]333771007^,OR,^[;/]293103002^,OR,^[;/]294639003^,OR,^[;/]407746005^,OR,^[;/]407737004^,OR,^[;/]259858000^,OR,^[;/]313587003^,OR,^[;/]252349000^,OR,^[;/]410509003^,),)

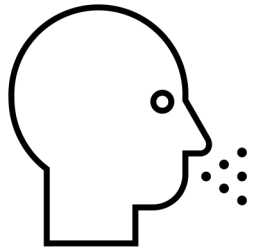
Final v2 definition had improved positive predictive value

	# Visits		Loss of true positives	Positive predictive value		Proportion of visits in ED		Proportion of visits in adults		Mean age reduction (years)
	V1	V2	V1 : V2	V1	V2	V1	V2	V1	V2	V1 : V2
VA	67	36	0	34%	64%	61%	47%	63%	44%	8.4
AZ	39	36	0	51%	56%	85%	86%	59%	56%	1
AK	19	18	-1 (gained a case)	53%	61%	100%	100%	32%	28%	1.9
Marion County, IN	46	34	0	46%	62%	78%	85%	37%	35%	1.67
Polk County, FL	2	0	0	0	NA	100%	NA	100%	NA	NA

Remaining limitations of the v2 definition

- **Some false positives remain:**
  - Hives, insect bites, allergic reactions, and unspecified dermatitis
- **Additionally, varicella identified using either the v1 or v2 definitions may reflect prior history of disease rather than acute disease**
  - Some hospitals enter all diagnosis codes from a patient's entire medical history, including prior history of varicella
  - these entries often have >50 discharge diagnosis codes

Goals for CDC Chickenpox v2 Definition usage: case, outbreak, and time-trend detection



- Currently, varicella is under-reported and reporting may not be representative
- There may be delays in case-reporting in NNDSS
- Syndromic surveillance can allow for early and more timely detection of potential outbreaks, improve case-finding and facilitate trend tracking to understand the incidence and burden of varicella

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Molly McKinney (WA)

Questions?

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Extra Slides

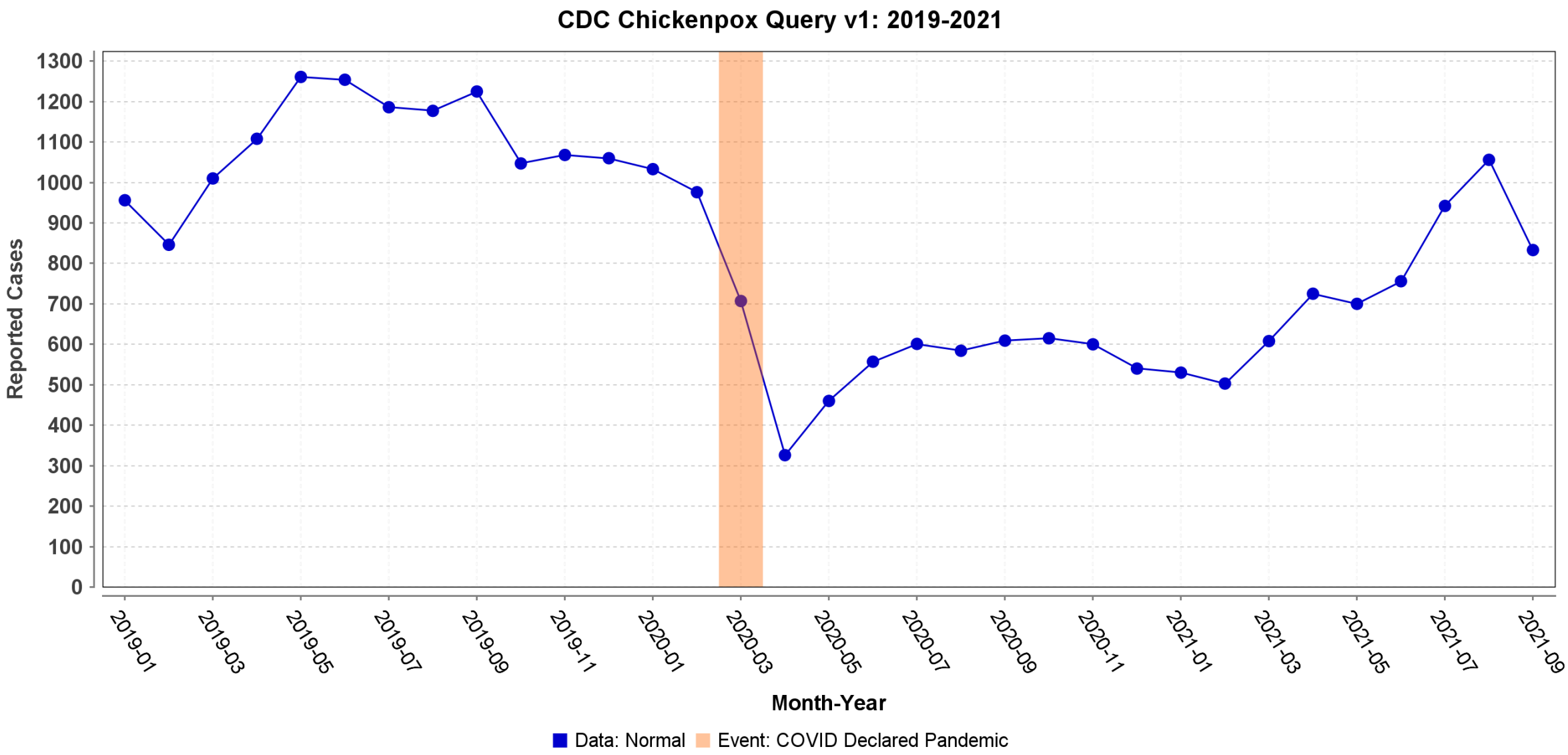
We explored, assessed, and propose to refine the query

1. **Understand the development and use of the Chickenpox v1 syndrome query** → Interviews: NSSP CoP, CDC Programs

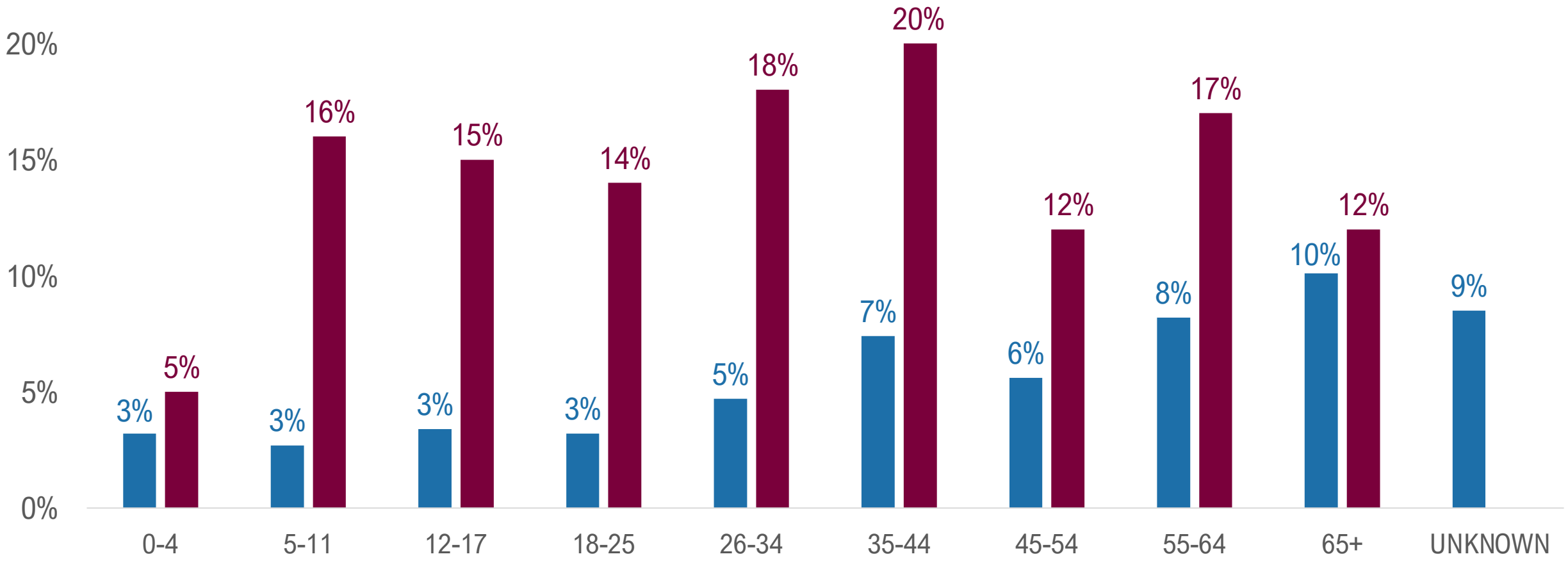
2. **Assess the syndrome's performance from the perspective of the CDC Varicella Program** → Quantitative & text-based analysis of existing syndromic query

3. **Refine the query with collaborators to improve the accuracy, sensitivity, and specificity** → Implement recommendations; find jurisdictions to partner with to pilot revised query

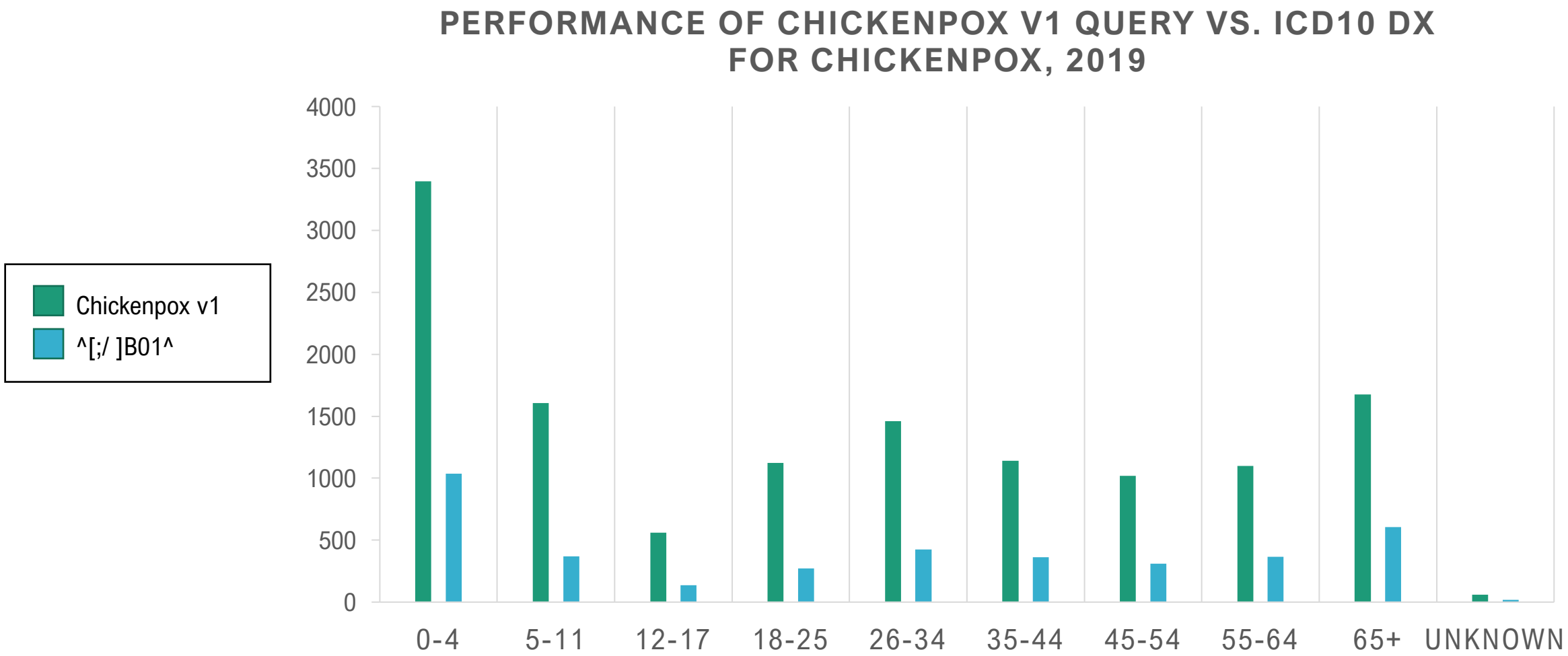
2019-present: performance of the varicella syndrome query



Comparing the % of ED varicella records with complications from **MarketScan 2018–2019** (n=599) and **NSSP 2019** (n=13,198) shows that severe visits are *under-represented* in NSSP data

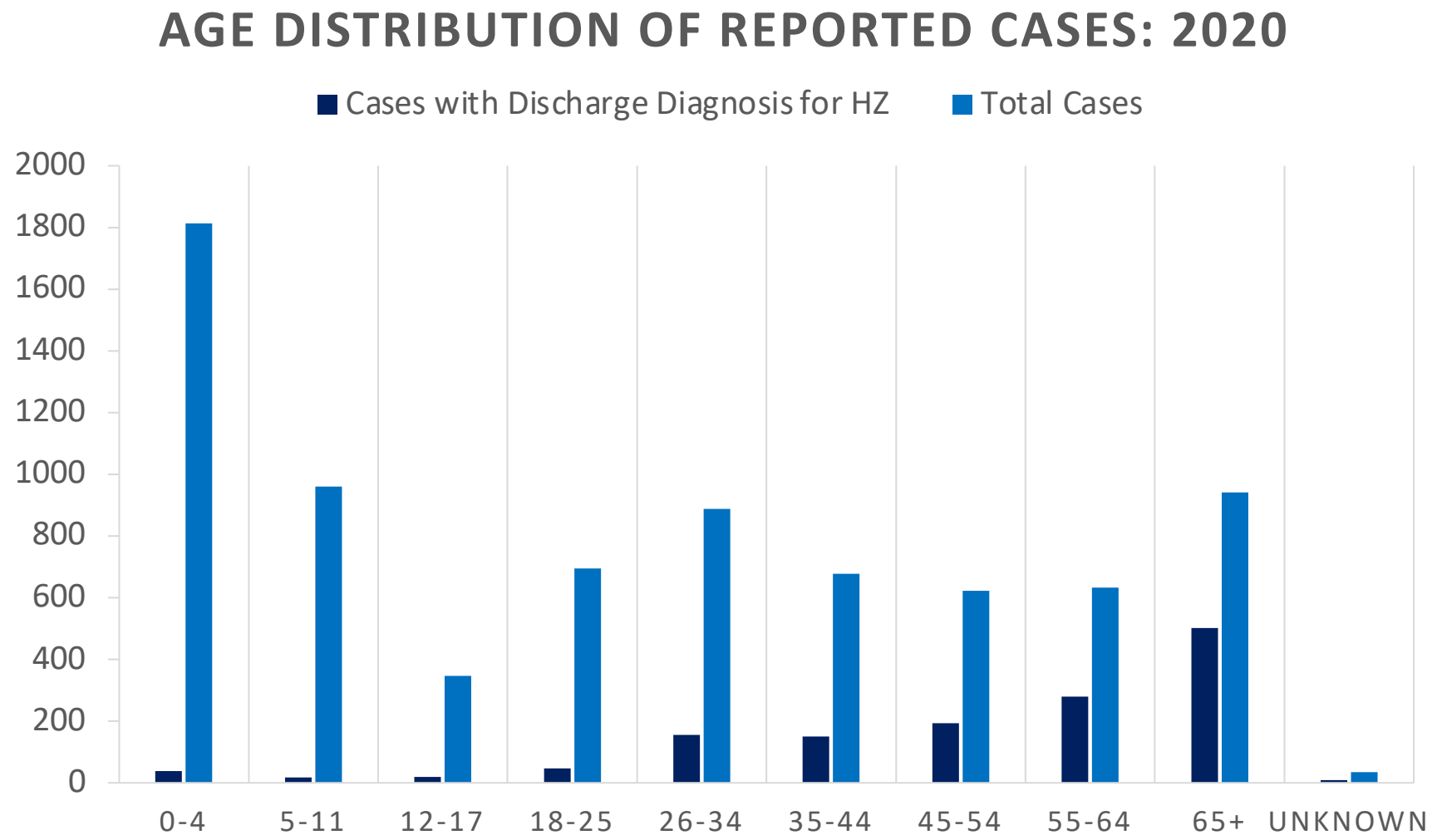


~1/3 of query results have an ICD10 diagnosis code



Zoster cases further over-represented in 2020

Age Group	Proportion of Cases
0-4	23.8%
5-11	12.6%
12-17	4.6%
18-25	9.1%
26-34	11.7%
35-44	8.9%
45-54	8.2%
55-64	8.3%
65+	12.4%
Unknown	0.4%



Detailed Recommendations

1. Change the logic so B01 is not negated by anything except for concurrent diagnosis with B02 (Zoster)
2. Remove outdated/removed from circulation SNOMED codes that have not appeared in ESSENCE data since 1992 (n = 31)
3. Remove duplicate SNOMED codes (n = 17)
4. Add zoster-specific codes as exclusion criteria
5. Add codes for Encounter for screening for other viral diseases (Z11.59) and Adverse effect of other viral vaccines (T50.B95A) to negation
6. Move Contact/Exposure to Varicella from inclusion to negation
7. Remove codes altogether that pertain to DNA assays/testing – these need not negate varicella because they are a test that would be ordered in order to diagnose varicella

Recommendation 2: Remove unused SNOMED codes

SNOMED CODE	Definition	Category	Current Status in the Query	Comments
186508005	[X] Varicella infection (& [chickenpox])	Chickenpox	Inclusion	REMOVED
154325003	[X] Varicella infection	Chickenpox	Inclusion	REMOVED
192732000	[X] Varicella transverse myelitis	Chickenpox (complication)	Inclusion	REMOVED
186513009	[X] varicella with no complication NOS	Chickenpox	Inclusion	REMOVED
186511006	[X] Varicella with other specified complications	Chickenpox (complication)	Inclusion	REMOVED
186512004	[X] Varicella with unspecified complications NOS	Chickenpox (complication)	Inclusion	REMOVED
187419000	[X]Varicella with other complications	Chickenpox	Inclusion	REMOVED
187420006	[X]Varicella without complications	Chickenpox	Inclusion	REMOVED
186510007	[X] Chickenpox pneumonia	Chickenpox (complication)	Inclusion	REMOVED
111858004	[X] Chickenpox with othe rspecified complications	Chickenpox (complication)	Inclusion	REMOVED
138696001	[X] H/O: Chickenpox	History of Disease	Negation	REMOVED (2002)
147732005	[X] Varicella contact	Contact/Exposure	Negation	REMOVED (2002)
333768004	[X] Anti-varicella-zoster ig injection	PEP/Immunity	Negation	REMOVED (2008)
68525005	[X] Varicella vaccination	Immunization	Negation	REMOVED (2017)
377005004	[X] Varicella virus vaccine live 1350pfu powder	Immunization	Negation	REMOVED (2005)
377008002	[X] Varicella virus vaccine live 1350pfu/0.5mL powder	Immunization	Negation	REMOVED (2018)
366846003	[X] Varicella zoster antibody level	PEP/Immunity	Negation	REMOVED (2002)
166226001	[X] Varicella zoster IgM level	PEP/Immunity	Negation	REMOVED (2002)
395187004	[X] Varicella zoster nucleic acid detection	Viral Assay	Negation	REMOVED (2003)
392854005	[X] Varicella zoster nucleic acid detection	Viral Assay	Negation	REMOVED (2003)
165975001	[X] Varicella-zoster IgG level	PEP/Immunity	Negation	REMOVED (2002)
421804006	[X] Varicella-zoster immune globulin 125 iu powder for injection solution vial	PEP/Immunity	Negation	REMOVED (2019)
407933006	[X] Varicella-zoster live attenuated vaccine injection (pdr for recon)+solvent	Immunization	Negation	REMOVED (2020)
424778000	[X] Varicella-zoster live attenuated vaccine powder 0.65mL vial + diluent	Immunization	Negation	REMOVED (2018)
120729003	[X] Varicellavirus antibody	PEP/Immunity	Negation	REMOVED (2010)
122141009	[X] Varicellavirus antibody assay	PEP/Immunity	Negation	REMOVED (2010)
121005009	[X] Varicellavirus antibody assay	PEP/Immunity	Negation	REMOVED (2010)
366768003	[X] Varicella zoster antibody level	PEP/Immunity	Negation	REMOVED (2002)
143590001	[X] Varicella zoster IgM level	PEP/Immunity	Negation	REMOVED (2002)
143362001	[X] Varicella-zoster IgG level	PEP/Immunity	Negation	REMOVED (2002)
413138007	[X] Chickenpox vaccination	Immunization	Negation	REMOVED (2004)

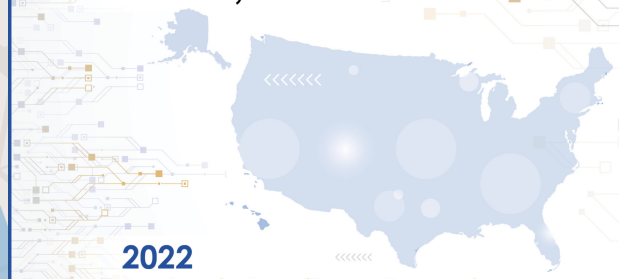
Recommendation 7: Remove inappropriate/incorrect codes

Term	Code Type	Definition	Category	Role in current query
19551004	SNOMED	Human herpesvirus 3	Chickenpox	Inclusion
402899000	SNOMED	Anetoderma following varicella	Chickenpox	Inclusion
Z20.820	ICD10	Contact with and (suspected) exposure to Varicella	Contact/Exposure	Inclusion
Z20820	ICD10	Contact with and (suspected) exposure to Varicella	Contact/Exposure	Inclusion
432721000124102	SNOMED	Maternal varicella infection	Contact/Exposure	Inclusion
428591000124108	SNOMED	Maternal varicella infection - untreated	Contact/Exposure	Inclusion
Z20.828	ICD10	Contact with and (suspected) exposure to other viral communicable diseases	Contact/Exposure	Negation
Z20828	ICD10	Contact with and (suspected) exposure to other viral communicable diseases	Contact/Exposure	Negation
432636005	SNOMED	Administration of MMR vaccine	Immunization	Negation
433733003	SNOMED	Administration of second MMR vaccine	Immunization	Negation
473164004	SNOMED	History of varicella vaccination	Immunization	Negation
419771007	SNOMED	[X] Measles/mumps/rubella/varicella vaccine powder and solvent for injection solution vial	Immunization	Negation
meningitis	Free Text Chief Complaint	meningitis	Other	Negation
710704003	SNOMED	Varicella zoster virus IgM	PEP/Immunity	Negation
315231005	SNOMED	Varicella-zoster virus antibody IgM measurement	PEP/Immunity	Negation
Z00129	ICD10	Encounter for routine child health examination without abnormal findings	Routine Health	Negation
Z00.129	ICD10	Encounter for routine child health examination without abnormal findings	Routine Health	Negation
122248009	SNOMED	Varicella virus antigen assay	Viral Assay	Negation
122202000	SNOMED	Varicella virus culture	Viral Assay	Negation
121197005	SNOMED	Varicella virus DNA	Viral Assay	Negation
122306004	SNOMED	Varicella virus DNA assay	Viral Assay	Negation
122293001	SNOMED	Varicella virus identification	Viral Assay	Negation
398503008	SNOMED	Varicella-zoster nucleic acid assay	Viral Assay	Negation
260214004	SNOMED	Varicella-zoster virus antigen	Viral Assay	Negation
445133005	SNOMED	Detection of Human herpesvirus 3 using polymerase chain reaction technique	Viral Assay	Negation

National Syndromic Surveillance Program

Community of Practice

Resources that Advance the Science and Practice of Syndromic Surveillance



2022 Syndromic Surveillance Symposium

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