

CDC Chickenpox (v2)
Definition Factsheet & Technical Brief

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Definition Purpose: To assist state, local, tribal, territorial, and federal public health practitioners in identifying patients likely to have varicella (chickenpox) by reviewing visits in the emergency department (ED) and urgent care (UC) settings for early varicella outbreak detection and to supplement case-finding using syndromic surveillance data.

Use-Cases for Definition:

- ☒ Case-finding
- ☒ Trend monitoring
- ☒ Early outbreak detection

New or Revised Definition: Revision of CDC Chickenpox v1

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Justification for New Version: CDC scientists initially evaluated the CDC Chickenpox v1 definition in August 2021 and determined that the v1 definition was overly sensitive and non-specific. The v1 definition pulled in visits not indicative of a suspected varicella case, such as visits for herpes zoster (shingles), varicella vaccination, varicella antibody titer draws, exposure to varicella, other viral exanthems (such as hand, foot, and mouth disease), molluscum contagiosum, and other generalized rash illnesses.

Development Methods: The CDC team, which included subject matter experts from the CDC Varicella and National Syndromic Surveillance Programs, worked with six jurisdictions (AK; AZ; Polk County, FL; Marion County, IN; VA, WA) to pilot revisions to the v1 definition using visit data from January – March 2021, and from April – July 2022.

1. The CDC team evaluated the diagnosis codes (International Classification of Diseases, 10th Revision (ICD-10-CM) and Systematized Nomenclature of Medicine (SNOMED)) in the v1 definition, assessing whether codes were necessary for identifying a suspect varicella case, sufficient, or should be removed or recategorized from inclusion to exclusion (or vice versa). The team also assessed additional codes that should be added into the definition that were not present in v1.
2. The CDC team reviewed the chief complaint terms and assessed whether they should be kept as an inclusion or exclusion term or removed from the revised definition.
3. The structure of the definition was modified such that some discharge diagnosis codes (i.e., ICD-10 codes for varicella (B01)) were prioritized, and non-specific terms were paired with variables indicative of acute rash illness to increase specificity.
4. Participating jurisdictions classified visits into true and false positives, and 'unknown', and compared positive predictive value (with true positives defined as varicella cases, comparing NSSP results to case-based surveillance) of the new definition (i.e., v2) to the v1 definition; a subset of jurisdictions also validated the revised definition against case-based surveillance data. Multiple sub-versions of the v2 definition were iteratively analyzed and refined until the current v2 (described in detail below) was finalized.

Definition Fields and Structure: The Chief Complaint Discharge Diagnosis (CCDD) field is used to query both the discharge diagnosis codes and chief complaint free text, with exclusions (as necessary), to develop the syndrome definition.

- Inclusion based on varicella-specific discharge diagnosis codes:
 - The visit is included if it contains:
 1. A discharge diagnosis code of varicella (B01)
 - The above must exclude:
 1. Concurrent discharge diagnosis code for shingles (B02) **OR**
 2. Concurrent discharge diagnosis code for routine child health examination without abnormal findings (Z00.129) **OR**
 3. Chief complaints related to a visit for vaccination, follow-up, or routine appointment ("annual", "follow up", "immunization", "physical", "return", "rtn", "screening", "shot", "vaccin", "vax", "well child", "well woman")
- Inclusion based on chief complaint terms or discharge diagnosis codes for varicella:
 - The visit is included if it contains:
 1. One of the following chief complaints: "chickenpox", "chicken pox", "varicella" **OR**
 2. A discharge diagnosis code for exposure to varicella **AND** (discharge diagnosis code or chief complaint of both rash **AND** fever) **OR**
 3. SNOMED codes indicative of varicella or varicella complications
 - The above must exclude:
 1. Concurrent chief complaint terms: "annual", "antibody", "bite", "follow up", "immunization", "inject", "inocu", "labs", "MMR", "physical", "PPD lab for varicella immunity", "prophyla", "return", "rtn", "rule out", "screening", "shingles", "shot", "Specimen collection", "titer", "titre", "titter", "vaccin", "vax", "well child", "well woman", "zoster", **OR**
 2. Concurrent diagnosis codes for shingles and shingles complications; differential diagnoses (i.e., hand, foot, and mouth disease, molluscum contagiosum, pityriasis rosea, other rash illnesses); and administrative exams and annual physicals

Validation Results: Jurisdictions found that the number of 'true positives' did not decrease (i.e., case-finding ability was preserved) and false positives were greatly reduced under the new final definition (v2) compared to v1, leading to an increase in definition positive predictive value from 42.8% (v1) to 60.5% (v2). Jurisdictions partnering with CDC to pilot this definition saw a reduction in the number of identified visits, without losing any true positive varicella cases – corresponding to increased positive predictive value from 53% to 61% in AK, 51% to 56% in AZ, 46% to 62% in Marion County, IN, and 34% to 64% in VA. These changes also reflected a reduction in the proportion of adults and a reduced mean age of patients identified by the definition (reflecting the removal of shingles from the inclusion criteria which tends to occur in older persons); the mean age decreased by 1 year in AZ to 8 years in VA. The v2 definition has better positive predictive value than v1, with substantially fewer false positives, and should be more useful for regional/jurisdictional time-trend analysis, early outbreak detection, and to supplement case finding.

Limitations: This definition has some limitations, including some false positives that remain (though infrequently), including hives, insect bites, allergic reactions, and unspecified dermatitis. Additionally, varicella identified using either the v1 and 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.

Detailed Definition Components

The CDC Chickenpox v2 definition mainly differs from the v1 definition by having greater specificity and thus a higher positive-predictive value, as the v2 definition excludes herpes zoster (shingles), while the v1 definition does not. Additionally, the v2 definition excludes visits for varicella vaccination and antibody titer draws, further improving the positive predictive value of the definition.

Table 1. *Inclusion and exclusion terms based on a case definition using varicella-specific discharge diagnosis codes, CDC Chickenpox v2 definition*

This portion of the definition identifies visits with a discharge diagnosis code for varicella (B01) and excludes concurrent discharge diagnosis codes for herpes zoster (B02) and administrative visits (Z00.129), as well as chief complaints pertaining to vaccination, annual/physical visits, and return visits.

Variable Type	Terms	Description (Diagnosis Codes Only)
Inclusions		
Discharge Diagnosis code – ICD-10	B01*	Varicella [chickenpox]
Exclusions		
Discharge Diagnosis code – ICD-10	B02*	Zoster [herpes zoster, shingles]
	Z00.129	Encounter for routine child health examination without abnormal findings
Chief complaint– free text	annual	
	follow up	
	immunization	
	physical	
	return	
	rtn	
	screening	
	shot	
	vaccin	
	vax	
	well child	
	well woman	

*All codes with B01 and B02 prefixes (for example, B01 includes all B01.xx diagnosis codes)

Table 2. Inclusion and exclusion terms based on a case definition using chief complaint terms or discharge diagnosis codes for varicella, CDC Chickenpox v2 definition

This portion of the definition identifies visits with (1) a chief complaint for varicella, (2) exposure to varicella (Z20.820) + rash and fever (chief complaint or discharge diagnosis codes), or (3) SNOMED codes for varicella. Visits are excluded if they have discharge diagnoses or chief complaint terms pertaining to differential diagnoses, administrative visits, vaccination visits, other rashes, bug bites, and vaccine-related adverse events.

Variable Type	Terms	Description (Diagnosis Codes Only)
Inclusions		
Chief Complaint – Automatic Inclusions	Chickenpox	
	Chicken pox	
	Varicella	
Chief Complaint – Fever and rash (either as discharge diagnoses or chief complaint terms) must appear in combination with discharge diagnosis code for exposure to varicella	Rash*	
	Fever*	
Discharge Diagnosis code – Fever and rash (either as discharge diagnoses or chief complaint terms) must appear in combination with discharge diagnosis code for exposure to varicella	R21*	Rash and other nonspecific skin eruption
	R50*	Fever of other and unknown origin
	Z20.820*	Contact with and (suspected) exposure to varicella
SNOMED codes – Automatic Inclusions	23737006	Chickenpox with complication
	24059009	Acute cerebellar ataxia due to varicella
	31920006	Hemorrhagic varicella pneumonitis
	38907003	Varicella
	90433002	Congenital varicella infection
	186509002	Postvaricella encephalitis
	195911009	Chickenpox pneumonia
	240468001	Neurological varicella
	240469009	Perinatal varicella
	277644009	Congenital varicella syndrome
	309465005	Varicella-zoster virus infection
	416718008	Varicella-zoster virus eyelid dermatitis
	715223009	Fetal varicella syndrome
	428591000124108	Maternal varicella infection – untreated
	432721000124102	Maternal varicella infection
Exclusions		
Discharge Diagnosis code –	B02**	Zoster [herpes zoster]
	B08.1	Molluscum contagiosum

ICD-10 – Automatic Exclusions	B08.4	Enteroviral vesicular stomatitis with exanthem
	L42	Pityriasis rosea
	T50.B95A	Adverse effect of other viral vaccines, initial encounter
	Z00.129	Administrative visit
	Z01.84	Encounter for antibody response examination
	Z02.89	Encounter for other administrative examinations
	Z11.59	Encounter for screening for other viral diseases
	Z11.1	Encounter for screening for respiratory tuberculosis
	Z23	Encounter for immunization
Discharge Diagnosis – SNOMED – Automatic Exclusions	62294009	Product containing varicella-zoster virus antibody
	104326007	Measurement of varicella-zoster virus antibody
	108729007	Varicella virus vaccine
	116813009	Administration of human immune globulin product
	116814003	Varicella virus immune globulin issued
	116868008	Administration of Varicella virus immune globulin
	134451006	Varicella-zoster virus antibody level
	252349000	Varicella-zoster virus T-lymphocyte stimulation
	259858000	Varicella-zoster virus antibody
	293103002	Varicella-zoster immunoglobulin adverse reaction
	294639003	Allergy to varicella-zoster virus antibody
	313587003	Varicella-zoster virus antibody immunoglobulin G measurement
	333771007	Product containing varicella-zoster virus antibody 500 milligram/1 vial powder for conventional release solution for injection
	333775003	Product containing precisely varicella-zoster virus antibody 250 milligram/1 vial powder for conventional release solution for injection
	371108009	Varicella non-immune
	371113008	Varicella immune
	390755008	Serologic test for varicella-zoster virus
	396442000	Varicella virus vaccine
	407737004	Varicella-zoster vaccine
	407746005	Varicella-zoster live attenuated vaccine
	410509003	Herpes zoster conjunctivitis
	412529007	Varicella virus live vaccine
	412530002	Varicella virus live vaccine
	413117001	Varicella status
	419550004	Measles + mumps + rubella + varicella vaccine
	419771007	Measles/mumps/rubella/varicella vaccine powder and solvent for injection solution vial
	425897001	Administration of vaccine product containing only Human alphaherpesvirus 3 antigen for chickenpox
	428502009	Administration of 2nd dose of varicella-zoster vaccine for chickenpox
	703344003	Requires varicella vaccination
	703486008	Varicella zoster virus IgG antibody
	6031000175102	Varicella vaccination not done
	451331000124106	Adverse reaction caused by varicella virus live vaccine
Chief complaint– free text – Automatic Exclusions	annual	
	antibody	
	bite	
	follow up	
	immunization	
	inject	

inocu	
labs	
MMR	
physical	
PPD lab for varicella immunity	
prophyla	
return	
rtn	
rule out	
screening	
shingles	
shot	
specimen collection	
titer	
titre	
titter	
vaccin	
vax	
well child	
well woman	
zoster	

*These terms must appear concurrently as specified in the table

**All codes with B02 prefixes (for example, B02 includes all B02.xx diagnosis codes)

Table 3. ESSENCE syntax, CDC Chickenpox v2 Definition

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(,^[/ JB01^,ANDNOT,(^[/ JB02^,OR,^[/ JZ00129^,OR,^[/ JZ00.129^,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,(,^[/
JZ20.820^,OR,^[/ JZ20820^),AND,(^rash^,OR,^fever^,OR,^[/ JR21^,OR,^[/ JR50^,)),OR,(,^[/
J24059009^,OR,^[/ J90433002^,OR,^[/ J277644009^,OR,^[/ J715223009^,OR,^[/ J31920006^,OR,^[/
J432721000124102^,OR,^[/ J428591000124108^,OR,^[/ J240468001^,OR,^[/ J240469009^,OR,^[/
J38907003^,OR,^[/ J416718008^,OR,^[/ J309465005^,OR,^[/ J186509002^,OR,^[/ J195911009^,OR,^[/
J23737006^,)),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,^[/ JB02^,OR,^[/ JZ1159^,OR,^[/ JZ11.59^,OR,^[/ JZ111^,OR,^[/
JZ11.1^,OR,^[/ JZ0184^,OR,^[/ JZ01.84^,OR,^[/ JB08.4^,OR,^[/ JB084^,OR,^[/ JB08.1^,OR,^[/ JB081^,OR,^[/
JZ02.89^,OR,^[/ JZ0289^,OR,^[/ JL42^,OR,^[/ JT50B95A^,OR,^[/ JT50.B95A^,OR,^[/ JZ23^,OR,^[/
JZ00129^,OR,^[/ JZ00.129^,OR,^[/ J116813009^,OR,^[/ J451331000124106^,OR,^[/ J425897001^,OR,^[/
J116868008^,OR,^[/ J419550004^,OR,^[/ J419771007^,OR,^[/ J104326007^,OR,^[/ J703344003^,OR,^[/
J428502009^,OR,^[/ J390755008^,OR,^[/ J371113008^,OR,^[/ J371108009^,OR,^[/ J413117001^,OR,^[/
J6031000175102^,OR,^[/ J116814003^,OR,^[/ J412530002^,OR,^[/ J412529007^,OR,^[/ J108729007^,OR,^[/
J396442000^,OR,^[/ J703486008^,OR,^[/ J134451006^,OR,^[/ J62294009^,OR,^[/ J333775003^,OR,^[/
J333771007^,OR,^[/ J293103002^,OR,^[/ J294639003^,OR,^[/ J407746005^,OR,^[/ J407737004^,OR,^[/
J259858000^,OR,^[/ J313587003^,OR,^[/ J252349000^,OR,^[/ J410509003^,))
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