

# Methodology for Public Health Immunization Measures Dashboard

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This document explains how immunization coverage is estimated in the Public Health Immunization Measures by County Dashboard. The version of this dashboard using these methods was last updated in March, 2026. A more detailed summary of data methodology may be requested by contacting [WAISDataRequests@doh.wa.gov](mailto:WAISDataRequests@doh.wa.gov).

These estimates differ from previously published data and are also not comparable to estimates from other sources of surveillance data. Beginning in 2023, the dashboard transitioned to recalculating coverage each year retrospectively, which means each year, past estimates are updated. Newly published estimates vary slightly from previous publications because the state immunization registry is always being updated. These estimates are also presumed to be underestimates of the true coverage rate because of a phenomenon in administrative databases called denominator inflation. These issues are described in more detail below. For these reasons, comparisons to past publications and other data systems such as the National Immunization Survey or Washington state's school-reported vaccine compliance data system should not be made.

The strengths and usefulness of coverage estimates from the WAIS include, but are not limited to:

- extensive provider reporting to WAIS with more frequent reports for children due to childhood vaccine schedule
- numerator and denominator data are being drawn from the same source
- most comprehensive source of information for many types of vaccines in Washington state (NIS has small sample size and school-reported compliance only reflects vaccines required for school)

## Washington State Immunization Information System (WAIS)

The dashboard uses data from the Washington State Immunization Information System (WAIS). The WAIS is a secure web-based tool, managed by the Washington State Department of Health. It is a lifetime immunization registry for residents of all ages. The information it contains is reported by licensed health care providers on a voluntary basis. WAIS data are considered medically verified. The WAIS contains more than 11.58 million unique individuals (born on or before December 31, 2023) from more than 2,900 different organizations (as of December 31, 2023). Health care providers that voluntarily report immunizations for their patients to the WAIS include:

- hospitals
- primary care providers
- pharmacists
- childcare centers
- schools

- WIC clinics
- STD/HIV clinics
- Tribal and Indian Health Services clinics
- family planning clinics

The percent of the population immunized is based on the population with data entered in the WAIS. Some people do not have records in the WAIS and not all immunizations are entered into the WAIS.

## Measures

### County of Residence

Patient county of residence is based on the most recently reported address that is prior to the given as-of-date.

### Race and Ethnicity Information

The source for race/ethnicity data is the Washington Immunization Information System (WAIS), as reported by the vaccine provider. It is dependent on the provider having and reporting accurate demographic information on the individual. Race and ethnicity are required fields in the WAIS, but providers may report these as “Unknown” or race as “Other”. The “Other” race category is a national HL7 data exchange standard, a drop-down menu option in WAIS, and a requested category by CDC.

Race/ethnicity is categorized following Office of Management and Budget (OMB) minimum categories for reporting. An individual is first identified as “Hispanic” as an ethnicity, and if not found to have “Hispanic” listed on their record, then race category is identified. Those with two or more race and ethnicity categories entered in their record are coded as “Multiracial”. This method allows for comparability with other state reports, as well as across states and federal entities, but may undercount people who identify with multiple race/ethnicity classifications.

Prior to December 2023, WAIS did not record multiple race reports from a single HL7 message. Only one race category was recorded unless updated another way, such as by direct data entry. Since then, up to three race categories can be recorded.

Please see the *Data Notes* section at the end of this document for more information.

### Coverage definitions

Coverage refers to the proportion of a population that is assumed to be immune to a vaccine-preventable disease. Immunity can be conferred by vaccination or prior exposure to the disease. The series estimated coverage is determined by each individual having all listed vaccines or documented lifetime immunity for a given disease. Those who are missing even one immunization in the total series are not considered complete for the series.

*Vaccine Series Definitions* – Doctors recommend that certain vaccinations be received at certain ages. To represent being up-to-date on the age-specific series, the number of vaccinations needed by that age are represented by medical shorthand. Details on each age-specific series are given below:

- *1 Birth dose Hepatitis B* – The birth dose of Hepatitis B is considered up to date if Hepatitis B vaccine is given within three days of birth. The measure is calculated among children born in the past calendar year who have a Washington State birth certificate file number in the WAIS.
- *4:3:1:3:3:1:4 vaccine series* - This series consists of 4+ doses of diphtheria, tetanus and acellular pertussis (DTaP) vaccine, 3+ doses of polio vaccine, 1+ doses of measles, mumps and rubella (MMR) vaccine, 3+ doses of hepatitis B (Hep B) vaccine, 3+ doses of Haemophilus influenzae type B (Hib) vaccine, 1+ dose of varicella (chickenpox) vaccine, and 4+ doses of pneumococcal conjugate vaccine (PCV). This series is used to calculate coverage for the 19 to 35 month-olds.
- *5:4:4:3:2:2:2:4 vaccine series* - This series consists of 5+ doses of diphtheria, tetanus and acellular pertussis (DTaP) vaccine, 4+ doses of Haemophilus influenzae type B (Hib) vaccine, 4+ doses of polio vaccine, 3+ doses of hepatitis B (Hep B) vaccine, 2+ doses of measles, mumps and rubella (MMR) vaccine, 2+ doses of varicella (chickenpox) vaccine, 2+ doses of hepatitis A (Hep A) vaccine, and 4+ doses of pneumococcal conjugate vaccine (PCV). This series is used to calculate coverage for the 4 to 6 year-olds.
- *1 dose HPV* – In January 2023, vaccine forecasting software used by providers was updated to recommend the first dose of Human papillomavirus starting at 9 years old. This series is used to calculate coverage for 9 to 10 year-olds.
- *1:1:1 vaccine series* - This series consists of 1+ dose of tetanus, diphtheria and acellular pertussis (Tdap) vaccine, 1+ dose of meningococcal conjugate (MCV) vaccine, and 1+ dose of human papillomavirus (HPV) vaccine. This series is used to calculate coverage for the 11 to 12 year-olds.
- *1:1:UTD vaccine series* - This series consists of 1+ dose of tetanus, diphtheria and acellular pertussis (Tdap) vaccine, 1+ dose of meningococcal conjugate (MCV) vaccine, and Up to Date (UTD 2+ doses) for human papillomavirus (HPV) vaccine. In 2017, recommended doses of HPV vaccine changed from 3 doses to 2 doses for most of those initiating the series before 15 years of age. This series is used to calculate coverage for the 13 to 17 year-olds.

## Analysis

Numerator counts greater than 0 and less than 10 are suppressed as well as rates derived from those suppressed counts.

## Inclusion/Exclusion Criteria

### Denominator

The denominator (total population) is based on the people with data entered in the WAIS. Some people are not represented in the WAIS and not all immunizations are entered into the WAIS.

Records which meet the following criteria are included in the denominator:

- WAIS records of patients who are living and fall within the milestone age ranges on the “as of the date” (AOD) of the coverage estimate.

- WAIS records where the most current address available in the system on the AOD is in Washington state.

We exclude WAIS records of people that are first created in the system after the AOD. This approximates the population of available records in the system on the AOD.

For the Hepatitis B birth dose measure, the rate is limited to records with birth dates in the past calendar year who have a Washington State Birth Certificate file number associated with their record. Birth Certificate information is periodically uploaded to the the WAIS.

## Numerator

The numerator is a subset of the denominator. It includes individuals who have one or more valid vaccinations associated with the vaccine series of interest, or documented evidence of immunity recorded in the registry by a health care provider by the AOD. Vaccine series coverage reflects whether an individual has completed all vaccines in a series. Those who are missing even one immunization in the total series are not considered complete for the series.

The Washington State Birth Certificate electronic form includes an indication of historical Hepatitis B administration at birth which is counted toward the Hepatitis B birth dose measure along with other birth dose reports from health care providers.

## Timing of Estimation

Estimates are based on data as of December 31 each year and are updated annually with the most current information. Data is generally extracted on January 31 of the next calendar year, unless stated otherwise (example: December 2025 data is extracted on January 31, 2026) to allow for manual entries and data adjustments to occur in the WAIS backend.

In the past, the dashboard was updated by appending new estimates to previous ones, without changing the older estimates. For example, estimates for 2018 were made in 2018 and for 2020 in 2020. Over time, this approach became increasingly difficult to maintain. New measures could not be calculated retrospectively, which reduced interest in new measures because trends could not be determined. And old coverage estimates could not be revised if the immunization registry was updated in a way the made new estimate incomparable to older estimates. Beginning in 2023, estimates are now calculated each year retrospectively. This allows us to add and revise measures as needed. Because the WAIS is constantly being updated, estimates will vary slightly on a year-to-year basis and should not be compared to previous years' data. This change was necessary to keep registry-based surveillance useful, but requires additional assumptions when determining coverage which can introduce error. These are discussed below.

## Sources of Error

### Denominator Inflation

The WAIS suffers from denominator inflation, meaning that it contains an excess number of records that do not have recent vaccine history. Coverage estimated using WAIS is an underestimate of true coverage rates because population denominators from WAIS are inflated with these inactive records. The 2022 WAIS Annual Report noted that the WAIS captured information for 127% of children 0-18 years old in the state based on Census estimates. All mature Immunization Information Systems struggle with this issue. Several factors contribute to denominator inflation.

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**Fragmented or duplicate records:** new records with missing or erroneous information cannot be merged to existing records, so, they are left in the system as separate records. These duplicates cannot be readily removed and accrue over time.

**Unreported residency changes:** providers don't always report when an individual moves out of Washington.

We do not currently have a way to resolve the issue of denominator inflation. There is no clearcut way to tell which records are inactive because they are duplicates and which ones are inactive because the individuals have not had recent vaccination data reported. Because these erroneous records don't represent real people or they represent people who have left and are no longer reporting vaccinations to WAIS, they will contribute to the denominator of a coverage rate, but not the numerator. This results in coverage estimates from WAIS generally being lower than estimates from other data sources.

## Border Counties and Underreporting

Coverage estimates in border counties tend to be lower than those in interior counties. This may be due to the area truly having lower population immunity or it may be due to unreported cross-border vaccinations. Sometimes individuals living in border counties with either Canada, Idaho or Oregon travel across Washington state boundaries to receive vaccinations. In these instances, administrations are not reported in the WAIS resulting in underreporting in border regions.

## Retrospective Estimates

Many pieces of information in the WAIS are only designed to reflect the *current* state of a record. Where a history of past values does exist, it is not designed to preserve a historical record and important information may be overwritten over time. This design structure becomes a source of error for retrospective estimates.

## Historical Address

We use the most recent address prior to the AOD to determine resident inclusion in coverage calculations. However, the address history table may be incomplete and old addresses may be overwritten. Incomplete history tables can cause increased variation the further back the estimate goes.

## Deceased Status

The WAIS categorizes patients as deceased based on vital statistics death record and provider report. For some records, the patient is marked as deceased, but there is no date of death or date the death was reported. In these cases, the patients are excluded from all estimates.

## Estimate "Drift"

Older estimates further back in time will "drift" over time. Routine updates and quality control measures will slowly remove or merge patient records. The number of records which "disappear" this way is relatively small, but changes accumulate over time. At the same time, new vaccine administration records may be added retrospectively. This means that rates calculated in different years will differ, even if using the same AOD.

## Data Notes

- The Washington State Department of Health is committed to honoring Tribal and Indigenous data sovereignty in all of our data products. We understand current data collection and analytic practices are not always inclusive or the best representation for people of different racial and ethnic backgrounds, including American Indians and Alaska Natives. We are committed to working on improving data collection, management, and reporting with Tribes and community partners in the future. We continue to engage partners and work as an Agency to improve both our data systems to capture more accurate data, and our data analyses practices to be more representative and inclusive of all groups.
- In February 2025, Immucast, a vaccine forecasting tool, was updated to version 2.0 for the WAIS. Effects of this change on coverage calculations were assessed and found to affect DTaP and Tdap. The two vaccines were now listed under the same family code, that of DTaP = 1, which produced incorrect coverage estimates for the 11-12 and 13-17 year-olds. A variable called IS\_TDAP along with an age requirement were incorporated into the coverage code for 11-12 and 13-17 year-olds to produce accurate estimates.
- As of December 2024 updates, Poliovirus estimates may vary slightly from previous calculations due to a 2024 conversion from doses of trivalent OPV (tOPV) documented as administered on or after 04/01/16 to OPV-unspecified. This ensures proper calculation of Poliovirus estimates moving forward.



**DOH 348-1154 March 2026**

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