



April 2021

- **In the News:** COVID-19 Vaccines are here; routine vaccinations are down; hepatitis A and tetanus in Colorado
- **Statewide Summary:** The latest data on vaccine preventable diseases (VPDs) in Colorado children and adults
- **Commentary:** Vaccine-Preventable Diseases in Adults in 2021

In the News: What's new and what's old in vaccines and vaccine preventable diseases

COVID-19 Vaccines: With FDA Emergency Use Authorization of COVID-19 vaccines beginning in December 2020 and several additional promising vaccine candidates in development, COVID-19 is now a vaccine-preventable disease. You can find more information about COVID-19 vaccines from the CDC, including detailed vaccine administration information for [health care providers](#), and answers to questions about [safety, precautions, and contraindications](#). Please check CDPHE's [website](#) for information on vaccine distribution and allocation in Colorado. Immunize Colorado has compiled answers to [FAQs](#), and the [Colorado Vaccine Equity Taskforce](#) is working to address disparities in vaccine access and improve equity. Our own Children's Hospital Colorado vaccine experts also have resources for [parents](#) and [clinicians](#).

Routine Pediatric Vaccinations Down: Researchers from the University of Colorado School of Medicine, Colorado School of Public Health, and CDPHE published a study in JAMA Pediatrics showing that pediatric vaccination delivery in Colorado dropped during the Spring and had not yet recovered to pre-pandemic levels by the beginning of May 2020.¹ Compared to the number of doses delivered January to March 15, doses delivered after March 15 to May were 31% lower for children 0-2 years, 78% lower for 3-9 years, and 82% lower for those 10-17 years of age.¹ If we do not make up for these missed doses, thousands of Colorado children may be left vulnerable to vaccine-preventable diseases. The consequences of this period of under-vaccination may only become clear as social distancing measures decrease in the coming year.

Hepatitis A: Colorado's hepatitis A outbreak that began in the Fall of 2018 has finally slowed down. As of January 2021, the outbreak seemed to be ending after infecting more than 400 people between 8 and 89 years of age across 27 Colorado counties.² This outbreak included 296 people hospitalized and 2 deaths. Public health officials have helped administer almost 25,000 vaccines to prevent more infections with hepatitis A. Hepatitis A is spread by fecal to oral transmission, usually through eating contaminated food or drinks related to poor hand hygiene.

Tetanus: In their December 2020 "Hot Topics in Infectious Diseases" newsletter, CDPHE reported a fatal case of tetanus in a Colorado adult.³ The patient developed muscle spasms and difficulty opening their jaw a few days after an injury while working outdoors. They died despite treatment with tetanus immune globulin and a tetanus vaccine. Adults should receive a tetanus-containing vaccine every 10 years as a booster. Colorado has seen 0-2 cases of tetanus per year since 2013;⁴ having a fatal case is notable.

What you can do to help:

Parents

- Call your pediatrician or primary care provider
- Make sure children and adolescents are up to date on their vaccinations now

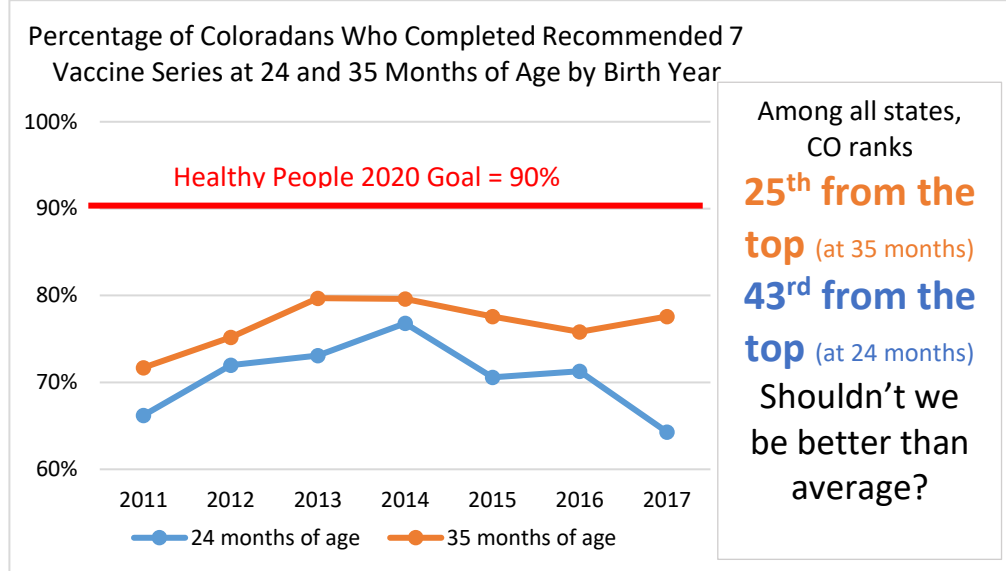
Health care providers

- Reduce missed opportunities for vaccination:
 - Check immunization status for every patient at both sick and well visits
 - Use standing orders for routine vaccinations
- Use reminder/recall systems to notify patients who are due or overdue for vaccinations

Most children are not yet eligible for a COVID-19 vaccine. Children may not be able to receive a COVID-19 vaccine at the same time as their other vaccines. The time to catch up on routine vaccinations is now.

Statewide Summary: *Vaccination rates lag behind other states and impact our youngest children the most*

Young children: Colorado falls short in vaccination coverage for our youngest children. Only 64% of Coloradans born in 2017 completed the recommended 7 vaccine series by 24 months of age, ranking Colorado 43rd out of 50 states.⁵ The CDC recommends completion of this series by 18 months of age, and it includes vaccinations to protect against measles, mumps, rubella, tetanus, diphtheria, pertussis, polio, *Haemophilus influenzae* B, hepatitis B, varicella, and pneumococcus.



By 35 months of age, 78% of Coloradans born in 2017 had completed the recommended 7 vaccine series, bringing Colorado up to the 25th ranked state for early childhood vaccination coverage.⁵ These data from the CDC show two problems: one in five Coloradans have not received all the recommended early childhood vaccinations by 35 months of age, and many children are receiving their early childhood vaccinations late. Very young children are vulnerable to sepsis and meningitis from infection with pneumococcus or *Haemophilus influenzae* as well as pneumonia and respiratory failure from pertussis or measles.

Children: In 2019, vaccine-preventable diseases resulted in over 14,000 hospitalizations and emergency department visits for Colorado children and over \$108 million in health care charges.

Table 1: Cases, rates, and charges for Colorado children 0-19 years of age with vaccine-preventable diseases, 2019.

Vaccine	Hospitalized Cases	Rate per 100,000	Hospital Charges	ED Cases	Rate per 100,000	ED Charges	Total Charges
<i>H. influenzae</i>	3	0.2	\$350,806	-	-	-	\$350,806
Hepatitis A	3	0.2	\$89,967	2	0.1	\$12,082	\$102,049
Hepatitis B	4	0.3	\$293,777	11	0.8	\$53,550	\$347,327
HPV	4	0.3	\$161,436	15	1.1	\$55,645	\$217,081
Influenza	688	48.4	\$53,704,092	13,862	974	\$41,761,583	\$95,465,675
Measles	1	0.1	\$46,081	1	0.1	\$3,742	\$49,823
Meningococcal disease	-	-	-	1	0.1	\$1,604	\$1,604
Mumps	4	0.3	\$283,301	9	0.6	\$47,742	\$331,043
Pertussis	7	0.5	\$772,879	28	2.0	\$72,253	\$845,132
Pneumococcal disease	58	4.1	\$9,263,333	12	0.8	\$77,480	\$9,340,813
Varicella/Zoster	11	0.8	\$1,256,238	127	8.9	\$243,617	\$1,499,855
Total	783	55.0	\$66,221,910	14,068	989	\$42,329,298	\$108,551,208

1 inpatient influenza death, and 2 inpatient pneumococcal disease deaths

Table 1 shows hospitalizations and emergency department (ED) visits associated with vaccine-preventable disease (VPDs) in Colorado 2019 and hospital-associated charges for these cases [Colorado Hospital Association (CHA) data]. Diagnoses were identified using ICD-10 codes. Population estimates from the Colorado Department of Local Affairs State Demography Office were used to calculate incidence rates. Cases of diphtheria (n=1), rubella (4) and tetanus (4) were omitted after review for diagnostic accuracy given methodologic limitations of ICD-10 data. These diseases are reportable to public health and CHA data did not align with CDPHE reports.

The Vaccine-Preventable Diseases Report

Children: Influenza, pneumococcal disease and varicella disease were the three most common reasons for hospitalization due to a VPD among Colorado children in 2019 (Table 1). Influenza, varicella disease and pertussis were the three most common VPDs associated with ED visits. The most common VPD to cause hospitalizations and ED visits was influenza with 688 hospitalizations, over 13,000 ED visits and \$95 million in associated charges among Colorado children in 2019.

Adults: Vaccine-preventable diseases caused over 20,000 hospitalizations and emergency department visits for Colorado adults in 2019, and resulted in over \$1 billion in health care charges.

Table 2: Cases, rates, and charges for Coloradans 20+ years of age with vaccine-preventable diseases, 2019.

Vaccine	Hospitalized Cases	Rate per 100,000	Hospital Charges	ED Cases	Rate per 100,000	ED Charges	Total Charges
<i>H. influenzae</i>	65	4.6	\$8,532,295	2	0.1	\$47,261	\$8,579,556
Hepatitis A	248	17.4	\$44,561,016	110	7.7	\$1,809,480	\$46,370,496
Hepatitis B	649	45.6	\$144,463,961	314	22.1	\$5,281,373	\$149,745,334
HPV	549	38.6	\$70,528,990	287	20.2	\$3,848,932	\$74,377,922
Influenza	3,095	217.6	\$285,501,030	9,060	637	\$67,746,610	\$353,247,640
Measles*	1	-	-	-	-	-	-
Meningococcal disease	2	0.1	\$274,695	1	0.1	\$29,195	\$404,890
Mumps	5	0.4	\$276,020	5	0.4	\$88,990	\$365,010
Pertussis	7	0.5	\$363,647	22	1.5	\$181,871	\$545,518
Pneumococcal disease	934	65.7	\$197,487,486	37	2.6	\$684,758	\$198,172,244
Polio/post-polio syndrome	355	25.0	\$41,374,285	207	14.6	\$3,691,790	\$45,066,075
Varicella/Zoster	1,025	72.1	\$126,058,437	3,191	224.3	\$19,481,114	\$145,539,551
Total	6,935	487.5	\$919,421,862	13,236	930	\$102,891,374	\$1,022,313,236

5 inpatient H. influenzae deaths, 4 inpatient Hepatitis-A deaths, 21 inpatient and 2 emergency department (ED) Hepatitis-B deaths, 4 inpatient and 1 ED HPV deaths, 81 inpatient and 2 ED influenza deaths, 62 inpatient pneumococcal disease deaths, 6 inpatient polio/post-polio syndrome deaths, and 10 inpatient and 1 ED varicella deaths.

Table 2 shows hospitalizations and emergency department (ED) visits associated with vaccine-preventable diseases (VPDs) in Colorado 2019 and hospital-associated charges for these cases [Colorado Hospital Association (CHA) data]. Diagnoses were identified using ICD-10 codes. Population estimates from the Colorado Department of Local Affairs State Demography Office were used to calculate incidence rates. Cases of diphtheria (n=2), measles (4), rubella (14) and tetanus (52) were omitted after review for diagnostic accuracy given methodologic limitations of ICD-10 data. These diseases are reportable to public health and CHA data did not align with CDPHE reports. *4/5 measles cases unverified, so cost data omitted.

Adults: Influenza, varicella and pneumococcal disease were the three most common reasons for hospitalizations due to a VPD among Colorado adults in 2019. The three most common reasons for ED visits with a VPD were influenza, varicella disease and hepatitis B. The most common VPD to cause hospitalizations and ED visits was influenza with over 3,000 hospitalizations, over 9,000 ED visits, and over \$353 million in associated charges among Colorado adults in 2019.

Specific Vaccine Preventable Diseases: Varicella disease data include diagnoses related to primary varicella infection (chicken pox) and varicella reactivation (e.g. shingles). Among children 0-19 years, varicella hospitalizations and ED visits were more commonly related to primary varicella infection; among adults ≥20 years of age, hospitalizations and ED visits were more commonly related to varicella reactivation.

We included HPV in this report for the first time this year and will follow this trend in Colorado hospitalization and ED visits over time. HPV-related diseases are more common in adults than in children. Among children, HPV-related hospitalizations and ED visits were for patients with anogenital warts. Adult HPV hospitalizations and ED visits included HPV-related cancers including oropharyngeal cancer, cervical cancer, and other anogenital cancers.

The Vaccine-Preventable Diseases Report

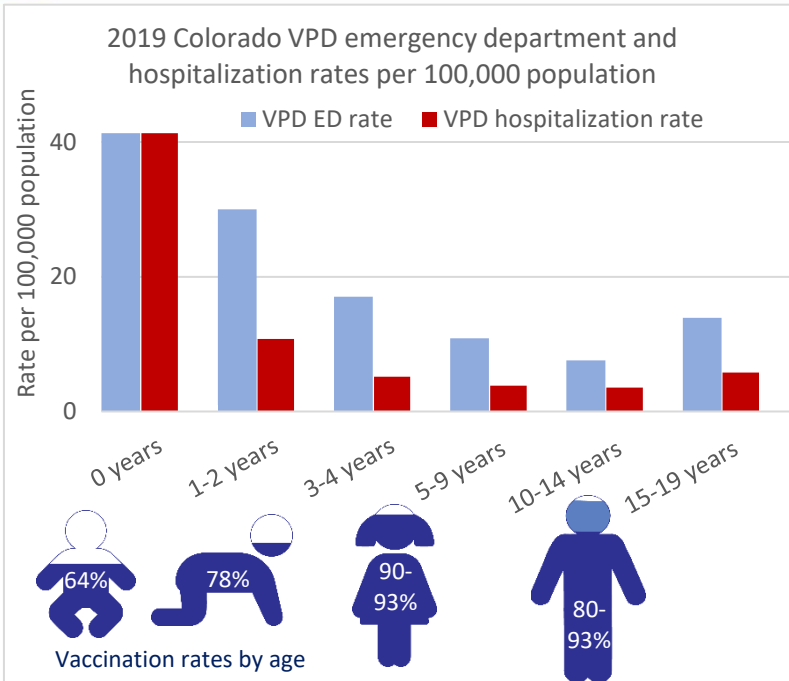


Figure 2: Pediatric hospitalization and ED visit rates for non-influenza VPDs by age. Colorado vaccination rates for 2019 (child figures) were 64% by 24 months of age, 78% by 35 months for childhood 7 vaccine series;⁵ 90-93% for kindergarten (90% 2 doses varicella, 91% 2 doses MMR, 93% 5 doses DTaP);⁶ 80-93% for adolescents 13-17-years-old (80% ≥1 HPV, 89% ≥1 MenACWY (meningitis), 91% 2 doses MMR, 91% ≥1 Tdap, 93% ≥3 HepB).⁷

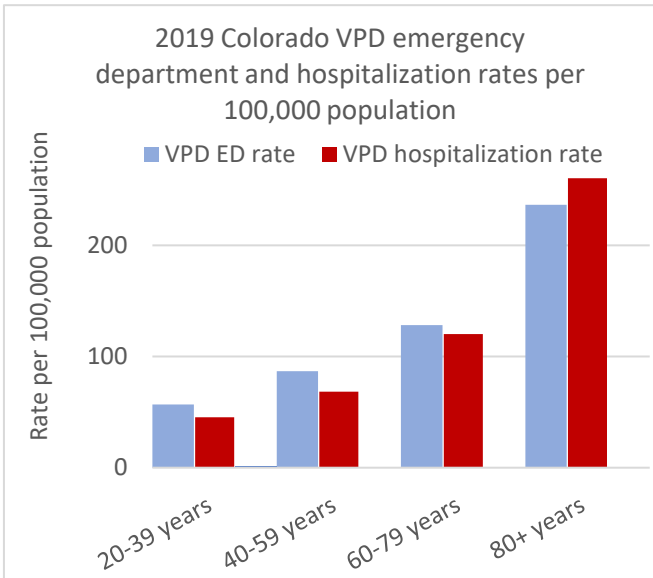


Figure 3: Adult hospitalization and ED visit rates for non-influenza VPDs by age.

insured/uninsured children and adults compared to commercially insured children and adults. In 2019, charges for hospitalizations and ED visits associated with VPDs among publicly insured/uninsured Coloradans totaled over \$900 million.

Hospitalizations and ED visits related to post-polio syndrome are a reminder that vaccine-preventable diseases threaten the acute and chronic health of Coloradans. Polio was eliminated in the United States in 1979, yet many older adults live with the lasting effects of polio disease contracted earlier in life.

Non-Influenza Vaccine Preventable

Diseases Across the Lifespan: We focused on non-influenza VPDs because state-level data for influenza vaccination rates by age are as not widely available as are vaccination rates for routine childhood immunizations. For children, rates of ED visits and hospitalizations for non-influenza VPDs are highest during the first three years of life when on-time vaccination rates are lowest. Higher vaccination rates by age 35 months compared to 24 months of age and higher rates among kindergarteners and adolescents suggest most children catch up on vaccinations over time, but under-vaccination early in life leaves children vulnerable to serious diseases.

Linking children to a medical home early in life and emphasizing the importance of recommended well child care in the first two years of life may help close early gaps in vaccination. Highlighting the increased risk of VPDs early in life may help to explain the reasons behind the recommended schedule in response to requests to spread out vaccines. Enforcing child care and school vaccination requirements, including implementation of [Colorado Senate Bill 20-163](#), can also help ensure children do not fall behind on vaccinations early in life.

Rates of ED visits and hospitalizations for VPDs are overall higher across adult age groups compared to children. VPDs impact older adults the most, particularly people over 80 years of age. Whereas VPDs among children result in more ED visits than hospitalizations, VPDs among adults are associated with high numbers of both hospitalizations and ED visits.

Economic Toll of VPDs by Payer Type: Total charges for ED visits and hospitalizations were much higher among publicly

	Hospital Charges	ED Charges	Total Charges
Children (0-19 years)	\$66,221,910	\$42,329,298	\$108,551,208
Commercially Insured	\$24,764,633	\$10,674,901	\$35,439,534
Publicly Insured / Uninsured	\$41,457,277	\$31,654,397	\$73,111,674
Adults (20+ years)	\$919,421,862	\$102,891,374	\$1,022,313,236
Commercially Insured	\$164,082,849	\$26,644,957	\$190,727,806
Publicly Insured / Uninsured	\$755,339,013	\$76,246,417	\$831,585,430

Table 3: Charges for hospitalizations and emergency department (ED) visits with a vaccine-preventable disease (VPD) in Colorado in 2019 by age and payer type

The Vaccine-Preventable Diseases Report

Vaccine-Preventable Diseases in Adults in 2021

By Amy Beeson, MD

While the concept of VPDs tends to call to mind measles and indignant toddlers, in 2021, we are due for an updated understanding of these missed opportunities for prevention. As the list of VPDs in adults continues to grow, the need for an invigorated strategy to improve vaccine coverage for adults becomes more apparent.

Vaccinating adults in Colorado is essential for several reasons. First, as the report above demonstrates, the burden of VPDs among adults in the state includes substantial morbidity, mortality, and healthcare expenditure. Second, VPDs are crucial as a matter of health equity: VPDs have been demonstrated to drive health disparities along the lines of race, socioeconomic status and healthcare access. Third, as the COVID-19 pandemic has vividly demonstrated, maintenance of an agile vaccine delivery infrastructure and a culture of vaccination among adults is critical to maintaining readiness for public health emergencies.

While vaccination and preventive visits are ingrained in the culture of pediatrics, adult vaccinations are not often afforded the same priority, and the vast majority of adults do not receive recommended preventive care.⁸ Those who care for adults must innovate to improve vaccine uptake. This may include strategies to provide more vaccinations outside of the primary care setting, e.g. for hospitalized patients, addressing gaps in insurance coverage for vaccines, expanding the use and utility of smart vaccine order sets, and public information campaigns and community outreach to build trust and promote knowledge of vaccine safety for adults. The current national COVID-19 vaccination campaign provides a unique opportunity to change the culture of vaccination for adults, bringing primary prevention to center stage where it belongs.

COVID-19 Vaccination Resources:

CDC: <https://www.cdc.gov/vaccines/covid-19/index.html>, <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/index.html>

CDPHE: <https://covid19.colorado.gov/vaccine>

Immunize Colorado: <https://www.immunizecolorado.org/healthcare-professionals/covid-19/covid-19-vaccine-faq>

Colorado Vaccine Equity Taskforce: <https://www.coloradovaccineequity.org/>

Children's Hospital Colorado: <https://www.childrenscolorado.org/conditions-and-advice/parenting/parenting-articles/covid-vaccine-updates/>, <https://www.childrenscolorado.org/health-professionals/coronavirus-professional-resources/covid-19-vaccine/>

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