



The Vaccine-Preventable Diseases Report

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- **In the News:** Hepatitis A Outbreak in Colorado, Ongoing Measles Outbreaks in the US
- **Back to School:** The latest data regarding vaccination rates in Colorado schools and child care facilities
- **Religion and Vaccines:** What do Colorado religious leaders think about vaccinations?
- **The Cost of Influenza:** How much money could we save by increasing influenza vaccination in Colorado?

In the News: What you need to know about Hepatitis A and measles

Hepatitis A: Hepatitis A is on the rise across the US. Over the past 3 years, there have been outbreaks in 30 states across the US with over 24,000 cases and 240 deaths reported, mainly in older adults.¹

Colorado has been experiencing an outbreak of hepatitis A since October of 2018. As in other recent hepatitis A outbreaks, the current epidemic has most affected people experiencing homelessness, people with substance use disorders, and people who are incarcerated. Since last fall, Colorado has had over 140 cases including over 100 hospitalizations. The largest number of cases have been reported in El Paso County.²

Hepatitis A can cause fever, vomiting, diarrhea, and jaundice. The disease is spread by fecal to oral transmission, often through consuming contaminated food or drinks related to poor hand hygiene. Spread also occurs through sexual contact and contaminated needles or other drug paraphernalia.

What can you do about measles?

Parents

- Make sure you and your family are vaccinated- the MMR vaccine is 97% effective in preventing measles

Health Care Providers

- Contact CDPHE if you think a patient may have measles or may have been exposed to someone with measles
- Vaccine recommendations for travel:

Infants <12 months	Children ≥12 months	Teens/adults without immunity
<ul style="list-style-type: none"> • Get early dose at 6-11 months • Follow schedule for another dose at 12-15 months, final dose at 4-6 years 	<ul style="list-style-type: none"> • First dose immediately • Second dose 28 days after first dose 	<ul style="list-style-type: none"> • First dose immediately • Second dose 28 days after first dose

- Measles information:
<https://www.colorado.gov/pacific/cdphe/measles>
<https://www.cdc.gov/measles/cases-outbreaks.html>

Public health officials and health care facilities are working to prevent the spread of hepatitis A through vaccination. Routine vaccination is recommended for all children beginning at 12 months and catch-up immunization is now recommended up to 18 years. Adults at high risk should be vaccinated including international travelers, people experiencing homelessness or substance use, men who have sex with men, people living with HIV or chronic liver disease, and people living with a child newly adopted from another country.

Measles: Measles outbreaks continue across the US, including in New York, Washington, and California. Over 1,200 cases have been reported across 30 states in 2019. One of every 10 cases has been hospitalized, with half experiencing complications.³

Colorado has low coverage for MMR (the vaccine that protects against measles), leaving the state vulnerable to an outbreak. Colorado Department of Public Health and Environment (CDPHE) school report data shows that only 87% of kindergarteners were up to date on MMR vaccine⁴, much below the 95% community immunity needed to prevent disease from spreading.^{5,6}

The US measles epidemic is mirroring the increased cases of measles across the globe from 2018 to 2019, including in Europe, Africa, Asia, and South America. It is important for people traveling internationally to be protected against measles. Early or accelerated vaccination may be needed.

If you are concerned about a suspected case of measles, please contact your state or local public health department.

Back to School: Helping families stay informed about their schools and child care facilities

The start of the school year is a time for parents and community members to think about the health and safety of Colorado schools and child care facilities. The Colorado Department of Public Health and the Environment (CDPHE) published its annual update of school and child care immunization rates earlier this summer, including an interactive database with maps and charts.

State legislation passed in 2014 requires Colorado schools and child care facilities to report immunization data to CDPHE. However, reporting was down for the 2018-19 school year, with only 89% of schools and 75% of child cares reporting, compared to 94% and 86% in 2017-18 (**Table 1**). This is particularly concerning because schools and child cares who do not report may have lower vaccination rates than those who do report.

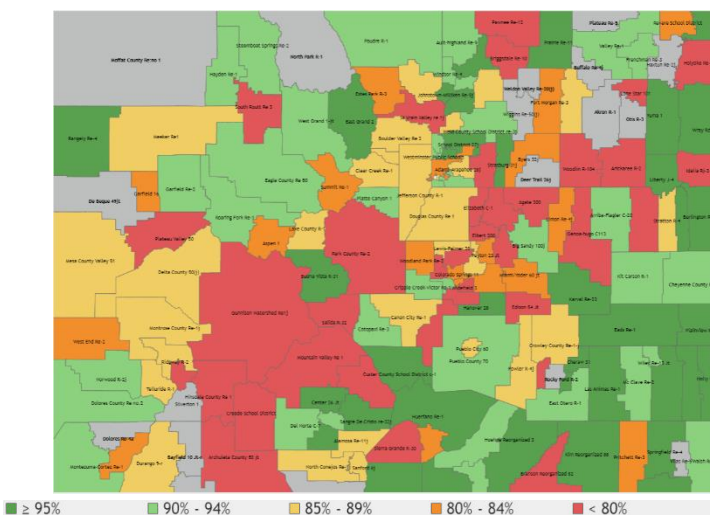
Table 1: 2018-19 Colorado School and Child Care Immunization Rate Reporting, Compliance, and Exemptions

	Schools (vaccines required for middle-school entry)	Kindergartens	Child Care Facilities & Preschools
Reporting: percentage of schools that submitted their immunization data to CDPHE	89%	88%	75%
Compliance (all required vaccines): percentage of students who have submitted proof of immunization or an exemption for all required vaccines	93%	88%	98%
Exemptions: percentage of students claiming an exemption for any one required vaccine	2.5-3.3%	4.1-4.9%	2.5-3.1%

For a student to be compliant with immunization requirements for school entry, they must submit a record of vaccination or an exemption for each required vaccine. While compliance was 98% among children in child care facilities and preschools, it was much lower for kindergarteners and older children. Those children who are not compliant have an unknown immunization status- they may not be protected against vaccine-preventable diseases or may simply not have submitted records.

Exemptions to immunization requirements remained steady from 2017-18 to 2018-19 with a high percentage of kindergartners still submitting exemptions. Among exemptions across all age groups, about 89% are personal belief exemptions, 7% religious, and 3-5% medical. This very low proportion of medical exemptions is similar to the number of medical exemptions seen in other states.

Compared to public schools (2.5-3.3%), private schools had higher exemption rates (5.4-6.2%), but they also had higher compliance rates with more private school students submitting complete immunization records or exemption forms. Among public schools, exemption rates were higher and fully vaccinated rates were lower in charter schools when compared to regular public schools, magnet schools or alternative education programs.



Unfortunately, MMR vaccination coverage has worsened between 2017-18 and 2018-19. As this map from the CDPHE school immunization data website shows, only about one in five Colorado school districts has a kindergarten MMR vaccination rate >95% (the threshold to prevent spread of measles in a community). For the 2018-19 school year, 87% of kindergartners were fully vaccinated and 4.5% submitted an exemption for MMR, compared to 89% fully vaccinated and 4.3% exemptions the prior year. For reporting child cares and preschools, 94% of children were fully vaccinated and 2.6% submitted an exemption, which was similar to last year.

More information about school and child care immunization rates is available here: <https://www.colorado.gov/pacific/cdphe/school-and-child-care-immunization-data>

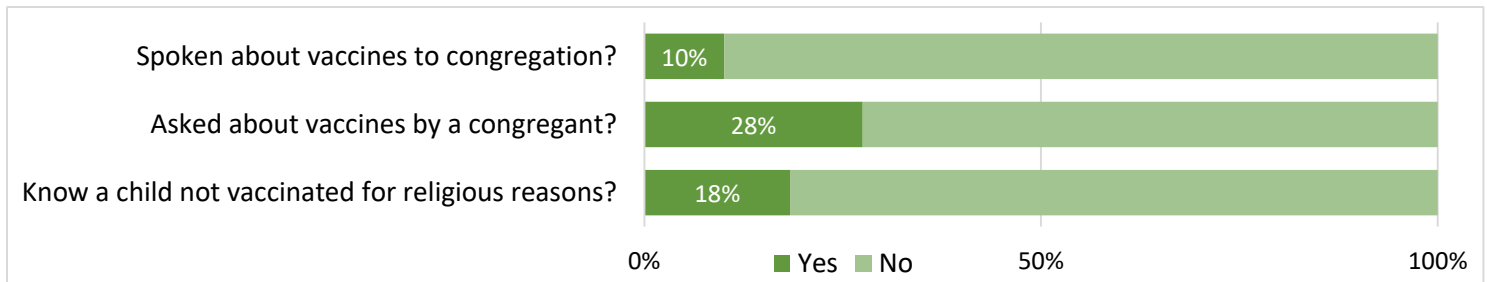
Religion and Vaccines: *What do Denver Clergy Think?*

Joshua T. B. Williams, MD

Religious exemptions to school- and childcare-required vaccinations are widely available in America, including in Colorado.⁷ Major religions support vaccination, but the national rate of religious exemptions has tripled over the past decade.^{8,9} For the 2017-2018 school year, about 2% of kindergartners received religious exemptions.⁷ Recent outbreaks of measles in religious communities have been tied to religious exemptions, and professional organizations are calling for their elimination.¹⁰ While some religious leaders have voiced support for vaccines in popular news outlets, we know little about most religious leaders' vaccine attitudes, practices, or experiences in their congregations.¹¹ As religious leaders may influence the attitudes and practices of their congregations, their vaccine views may be important.

In 2016, we conducted a survey of Denver religious leaders to learn more about how they viewed vaccines and whether or not they addressed vaccines in their congregations.¹² Over 100 religious leaders responded; most were parents, Protestant, white, male, and experienced leaders of smaller congregations with children. Of those who responded, 75% were not hesitant about vaccines, only 18% knew a child who had not received a vaccine for religious reasons, and just 10% had formally spoken about vaccines in their congregations (Figure 1). Most clergy who had spoken about vaccines mentioned the need for congregants to get vaccines to protect those who could not get them, as well as the need to thoroughly research vaccines before making a personal decision about them.

Figure 1. Denver religious leaders' (n = 109) experiences with vaccines in their congregations.



Overall, most Denver religious leaders were not hesitant about vaccines, but few had spoken up in their favor. Follow-up interviews with clergy suggest that many don't feel responsible to talk about vaccines because of competing priorities or a lack of interest in their congregations.¹³

In the 2018-2019 Colorado school-year, religious exemptions accounted for ~7% of all exemptions.⁴ The absolute number of children with religious exemptions in Colorado is low. However, children with religious exemptions are at risk of vaccine-preventable diseases – and still at risk of spreading them to others – particularly when they cluster in small communities. Given the consequences of vaccine-preventable diseases and the reality of religious exemptions in Colorado, clergy may be an important missing voice in the calls to make Colorado communities healthier for everyone.

The Cost of Influenza: *How increasing influenza vaccination can save Colorado money*

As many people are already preparing for the 2019-20 influenza season, we look back at the impact of the severe 2017-18 influenza season in Colorado. The CDC estimates that close to 49 million people were sick with influenza in 2017-18, 1 million were hospitalized and over 79,000 died.¹⁴ Nationwide, 183 children died from influenza while over 70% of hospitalizations and 90% of deaths occurred in adults ≥65 years. Although some vaccine-preventable diseases have a greater impact on children, influenza infects people of all ages, and older adults are especially at risk of becoming very ill or dying.

Because the type of influenza virus circulating changes from year to year, a new combination influenza vaccine is required each season. One challenge in preventing influenza is that the vaccine is sometimes less effective due to this matching process. The 2017-18 vaccine was 38% effective overall at preventing influenza infection, and its impact varied across age groups.¹⁵ A second challenge is the low rate of influenza vaccination. The yearly influenza vaccine is recommended for everyone over 6 months of age, but only 45% of Coloradans received the vaccine in 2017-18.

Impact of 2017-18 Influenza Season on Coloradans: Across Colorado 4,753 people were hospitalized for influenza from July 2017 through June 2018 resulting in \$264 million in hospital charges. In addition, 20,550 people visited an Emergency Department (ED) due to influenza, resulting in \$103 million in charges. The distribution of charges across the different Regional Accountable Entities (RAEs, the accountable care organizations for Colorado Medicaid) is shown in **Figure 2**.

RAE	Hospitalizations	ED Visits	Total Charges
1	\$27,336,503	\$9,190,958	\$36,527,461
2	\$14,434,710	\$6,218,611	\$20,653,321
3	\$84,442,572	\$33,850,515	\$118,293,087
4	\$23,162,951	\$7,327,130	\$30,490,081
5*	\$39,594,485	\$15,054,788	\$54,649,273
6	\$54,162,737	\$18,875,394	\$73,038,131
7	\$21,116,765	\$13,000,321	\$34,117,086
Total (whole state)	\$264,250,723	\$103,517,717	\$367,768,440

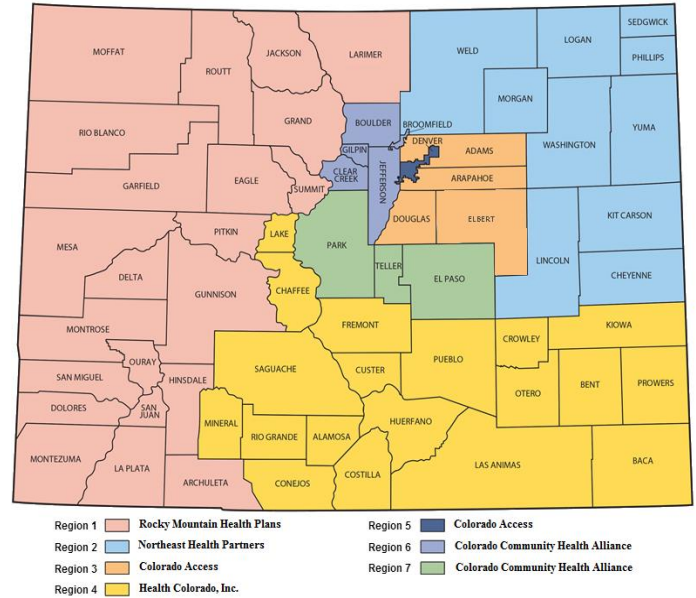


Figure 2: 2017-18 Influenza-associated Hospital and ED Charges in Colorado by Regional Accountable Entity (RAE), *RAE 5 charges may be underestimated due to missing data

While the highest rate of ED visits for influenza occurred among children ≤ 4 years, the highest number (over 2,700) and rate of influenza hospitalizations for any age group occurred in adults ≥ 65 years. Hospitalizations and ED visits totaled over \$163 million in charges for people ≥ 65 years and more than \$159 million for adults 18-64 years.

Economic Impact: Influenza leads to absenteeism from work and school. Based on published studies and local survey data, we estimated the number of days that an employee would miss work for an influenza hospitalization or an ED visit due to their own illness¹⁶ or illness of a child.¹⁷⁻²² We used the average wage for a Colorado worker to calculate the wages lost for each day of work missed and applied a lost productivity multiplier based on economic studies measuring additional productivity costs incurred by a business when an employee misses work (**Table 2**).^{23,24} Influenza hospitalizations and ED visits among adults aged 18-64 years cost Coloradans over \$11 million in lost wages and productivity in 2017-18. Adults missing work for a child with an influenza hospitalization or ED visit cost \$3.6 million dollars in lost productivity and wages.

Table 2: Work Absenteeism and Lost Wages/Productivity Due to Influenza Hospitalization and ED visits in Colorado, 2017-18

	Days of Work Missed per Case	Total Days of Work Missed	Lost Wages and Productivity
Hospitalizations: adults 18-64 years old	5.75	8,838	\$3,055,203
ED visits: adults 18-64 years old	2.75	23,482	\$8,117,795
Hospitalizations: children 0-17 years old	2.00	966	\$333,945
ED visits: children 0-17 years old	1.00	9,443	\$3,264,438
Totals	-	42,729	\$14,771,381

Potential Impact of Increased Vaccination: Even though the influenza vaccine is not 100% effective in preventing influenza, the costs of influenza could be reduced by improving vaccination rates. We calculated the influenza cases and costs that were prevented based on 2017-18 vaccination rates across different age groups in Colorado and predicted the cases and costs that could be prevented by increasing vaccination rates to the CDC Healthy People 2020 goal of 70%. With Colorado's 2017-18 influenza vaccination rates - an average of 45% across all ages - over 570 hospitalizations, 2,600 ED visits, and \$68 million in hospital and ED charges from influenza were prevented. If we increased Colorado's vaccination rates to 70%, we could prevent an additional 220 hospitalizations, 1,300 ED visits, and 4,000 missed work-days.

Increasing influenza vaccination rates to 70% would prevent \$22 million in hospital and ED charges and \$1.4 million in lost wages and productivity.

The number of influenza cases that we could prevent by increasing vaccination is an underestimate. Vaccine effectiveness only accounts for the protection that the vaccinated individual receives. In reality, the benefits of one person receiving the vaccine extend to protect their family, friends, and colleagues from being exposed to and getting sick with influenza.

References

- Centers for Disease Control and Prevention. Widespread outbreaks of hepatitis A across the United States. 2019; <https://www.cdc.gov/hepatitis/outbreaks/2017March-HepatitisA.htm>. Accessed August 14, 2019, 2019.
- Colorado Department of Public Health and Environment. Colorado Hepatitis A Outbreak Report. 2019; https://docs.google.com/document/d/e/2PACX-ivSrN6YvR6zibn7hg7g78DpjhQYEZR3H7H34_Pl1As8Uo237X82NmRR_xdpseSyNuJ6gWIKyFBWt7pG3/pub. Accessed August 29, 2019, 2019.
- Centers for Disease Control and Prevention. Measles Cases and Outbreaks. 2019; <https://www.cdc.gov/measles/cases-outbreaks.html>. Accessed August 29, 2019.
- Colorado Department of Public Health and Environment. State of Colorado 2018/2019 School and Child Care Immunization Data. 2019; <https://www.cohealthdata.dphe.state.co.us/Data/Details/899902>. Accessed August 14, 2019, 2019.
- De Serres G, Gay NJ, Farrington CP. Epidemiology of transmissible diseases after elimination. *Am J Epidemiol*. 2000;151(11):1039-1048; discussion 1049-1052.
- Thompson KM. Evolution and Use of Dynamic Transmission Models for Measles and Rubella Risk and Policy Analysis. *Risk Anal*. 2016;36(7):1383-1403.
- Mellerson JL, Maxwell CB, Knighton CL, Kriss JL, Seither R, Black CL. Vaccination Coverage for Selected Vaccines and Exemption Rates Among Children in Kindergarten - United States, 2017-18 School Year. *MMWR Morbidity and mortality weekly report*. 2018;67(40):1115-1122.
- Grabenstein JD. What the world's religions teach, applied to vaccines and immune globulins. *Vaccine*. 2013;31(16):2011-2023.
- Omer SB, Porter RM, Allen K, Salmon DA, Bednarczyk RA. Trends in Kindergarten Rates of Vaccine Exemption and State-Level Policy, 2011-2016. *Open Forum Infect Dis*. 2018;5(2):ofx244.
- American Academy of Pediatrics. Elimination of non-medical vaccine exemptions ranked top priority at Annual Leadership Forum. *AAP News*. 2019; <https://www.aappublications.org/news/2019/03/16/alfresolutions031619>. Accessed August 5, 2019, 2019.
- McNeil DG. Religious objections to the measles vaccine? Get the shots, Faith leaders say. *The New York Times*. April 26, 2019, 2019.
- Williams JTB, O'Leary ST. Denver Religious Leaders' Vaccine Attitudes, Practices, and Congregational Experiences. *J Relig Health*. 2019;58(4):1356-1367.
- Williams JTB, Nussbaum, A. M., O'Leary, S. T. . Building Trust: Clergy and the Call to Eliminate Religious Exemptions. *Pediatrics*. 2019; Accepted, in press.
- National Center for Immunization and Respiratory Diseases. Estimated Influenza Illnesses, Medical visits, Hospitalizations, and Deaths in the United States — 2017–2018 influenza season. 2018; <https://www.cdc.gov/flu/about/burden/2017-2018.htm>. Accessed April 10, 2019, 2019.
- Rolfes MA, Flannery B, Chung J, et al. Effects of Influenza Vaccination in the United States during the 2017-2018 Influenza Season. *Clin Infect Dis*. 2019.
- Tsai Y, Zhou F, Kim IK. The burden of influenza-like illness in the US workforce. *Occup Med (Lond)*. 2014;64(5):341-347.
- Li S, Leader S. Economic burden and absenteeism from influenza-like illness in healthy households with children (5-17 years) in the US. *Respir Med*. 2007;101(6):1244-1250.
- Heikkinen T, Silvennoinen H, Heinonen S, Vuorinen T. Clinical and socioeconomic impact of moderate-to-severe versus mild influenza in children. *Eur J Clin Microbiol Infect Dis*. 2016;35(7):1107-1113.
- Willis GA, Preen DB, Richmond PC, et al. The impact of influenza infection on young children, their family and the health care system. *Influenza Other Respir Viruses*. 2019;13(1):18-27.
- Palmer LA, Rousculp MD, Johnston SS, Mahadevia PJ, Nichol KL. Effect of influenza-like illness and other wintertime respiratory illnesses on worker productivity: The child and household influenza-illness and employee function (CHIEF) study. *Vaccine*. 2010;28(31):5049-5056.
- Mughini-Gras L, Pijnacker R, Enserink R, Heusinkveld M, van der Hoek W, van Pelt W. Influenza-like Illness in Households with Children of Preschool Age. *Pediatr Infect Dis J*. 2016;35(3):242-248.
- Rao S. Personal Communication- Survey data from parents of children aged 6 months to 8 years who presented to an emergency department or urgent care in Colorado who were diagnosed with influenza. In:2019.
- Nicholson S, Pauly MV, Polsky D, Sharda C, Szrek H, Berger ML. Measuring the effects of work loss on productivity with team production. *Health Econ*. 2006;15(2):111-123.
- Bureau of Labor Statistics. May 2018 State Occupational Employment and Wage Estimates. 2019; https://www.bls.gov/oes/current/oes_co.htm. Accessed April 10, 2019, 2019.

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