Maternal and Child Health
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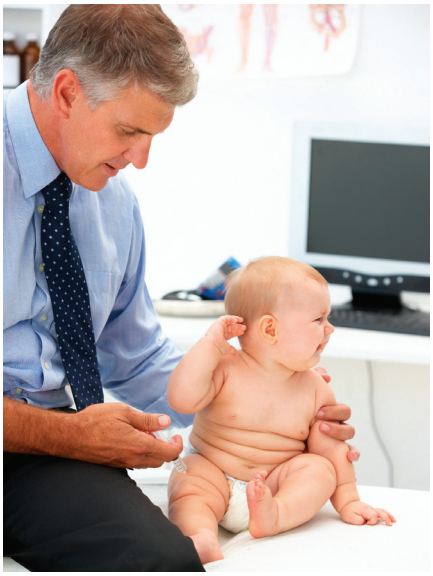
Early Childhood Immunizations in Colorado



Why is early childhood immunization important?

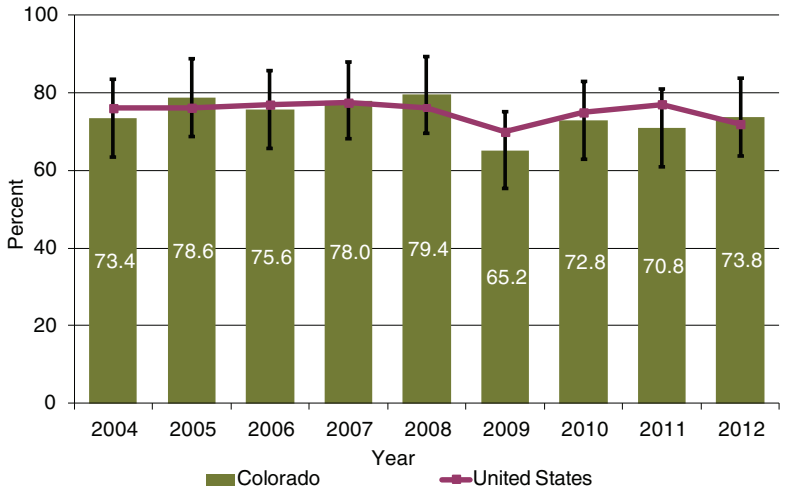
Vaccines are one of the most successful and cost-effective prevention tools available to public health systems.[1,2] Routine childhood immunization has helped to prevent many infectious diseases in the United States over the last four decades and eradicate smallpox.[2,3] Policy interventions such as immunization requirements for child care and school entry have helped increase vaccination coverage and decrease vaccine-preventable diseases (VPDs).[1] Infectious disease prevention is one of Colorado's Winnable Battles, with a focus on increasing the percentage of children up-to-date on their diphtheria, tetanus, and pertussis (DTaP) immunizations upon school entry into kindergarten.[4]

What is the prevalence of childhood immunization?

Since 2004, the vaccination rate for the 4:3:1:3:3:1* series among Colorado children 19-35 months of age has remained consistent, averaging about 75 percent (Figure 1). Colorado did not meet the Healthy People 2020 (HP 2020) goal of 80 percent of children aged 19-35 months to be completely immunized for the recommended vaccine series.[5,6]

Colorado requires vaccines for child care (care for children 0-5, before school entry) including DTaP, polio, MMR, Hib, Hep B, varicella, and PCV (Table 1, see Appendix).[7] In 2012, the individual vaccine coverage rate for 4+DTaP was significantly lower than the rate for 3+DTaP in Colorado for children by 19 months of age.**[6] Colorado requires four doses of DTaP by 19 months.[7] The difference in the rates for the 3+DTaP and the 4+DTaP vaccine demonstrates that multi-dose series vaccines have lower vaccination coverage rates.** Colorado did not meet the HP2020 goal of 90 percent for some recommended doses (4+DTaP, full series Hib, 1+Var, 4+PCV, Rotavirus) for individual vaccines among children aged 19-35 months.[5,6]

Figure 1. 4:3:1:3:3:1* vaccination coverage among children 19-35 months of age by year, Colorado and the United States.[6]



* ≥4 doses of DTaP (diphtheria, tetanus, pertussis) vaccine, ≥3 doses of polio vaccine, ≥1 doses of any MMR (measles, mumps, rubella) vaccine, ≥3 doses of Hib (Haemophilus influenzae type b) vaccine, ≥3 doses of HepB (hepatitis B) vaccine, and ≥1 doses of varicella vaccine
** 3+DTaP = 93.3 (89.5, 97.1); 4+DTaP = 69.4 (61.4, 77.4)

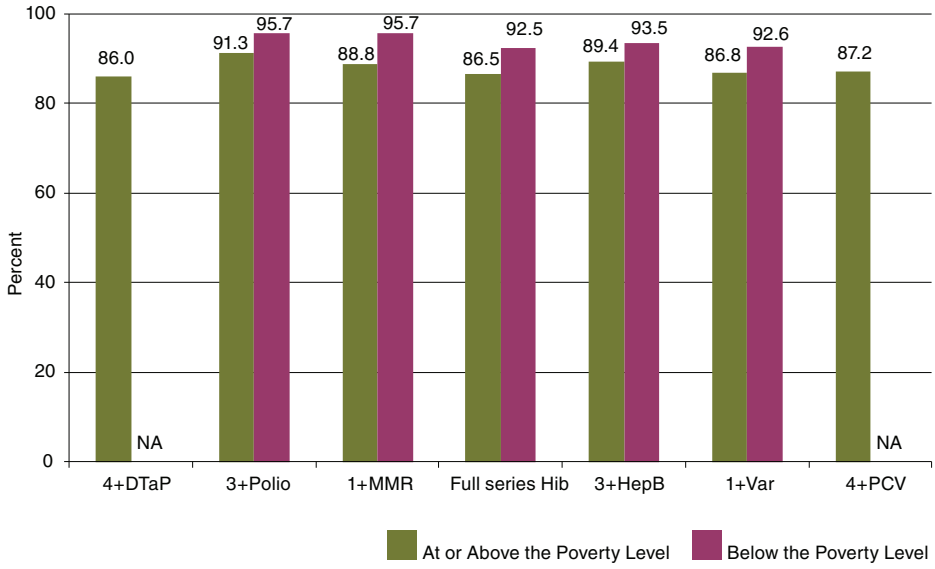
NOTE:
- In 2009 CDC changed the definition of what was up-to-date for Hib. Full series Hib: ≥3 or ≥4 doses of Hib vaccine depending on product type received (includes primary series plus the booster dose).
- The CDC changed the National Immunization Survey (NIS) series used to report coverage rates for children 19-35 months of age. The new series used for reporting includes 4 PCV (pneumococcal conjugate vaccine). The HP 2020 goal for the 4:3:1:3:3:1:4 series is still to be at or exceed 80 percent. Colorado child care immunization requires PCV vaccination.[5,7]

Healthy People 2020 Goals[5,8]

Increase the proportion of children aged 19 to 35 months with individual vaccine coverage to 90 percent and completion of recommended vaccine series to 80 percent.

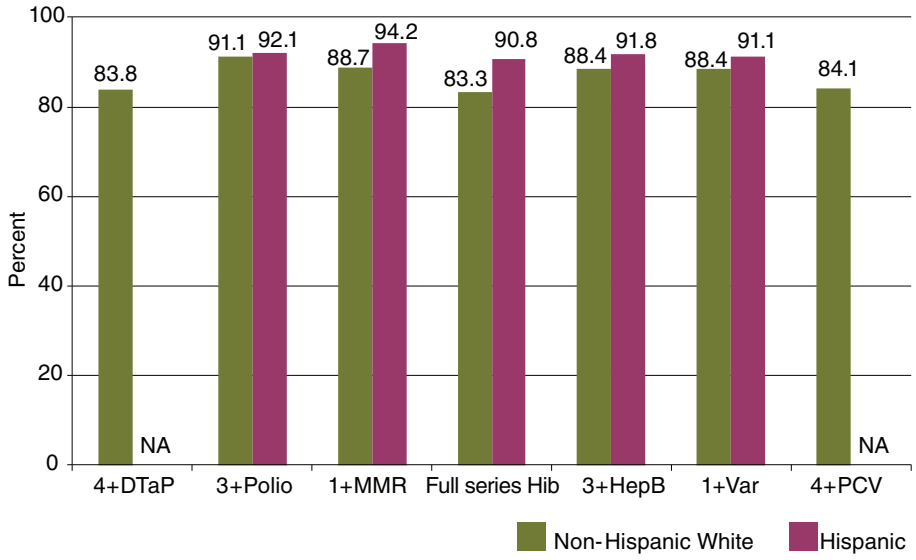
Social and economic health disparities

Figure 2. Vaccination coverage among children 19-35 months of age by vaccine type and poverty status, Colorado, 2012.[6]



There were no significant differences in individual vaccine coverage among Colorado children 19-35 months of age by poverty status.[6] Overall, children below the poverty level had slightly higher rates of vaccination coverage for individual vaccines compared with those at or above the poverty level; this may be due to the Vaccines for Children Program (VFC) implemented in Colorado. The VFC program is a federally funded program that provides vaccines at no cost to children who might not otherwise be vaccinated because of inability to pay.[9]

Figure 3. Vaccination coverage among children 19-35 months of age by vaccine type and race/ethnicity, Colorado, 2012.[6]



There were no significant differences in individual vaccine coverage among Colorado children 19-35 months of age by race/ethnicity.[6] Overall, Hispanic children of all races had slightly higher rates of vaccination coverage for individual vaccines when compared with non-Hispanic whites. Children of Hispanic descent in Colorado are three times as likely to be uninsured when compared with non-Hispanic white children, and are subsequently more likely to qualify for vaccines through the VFC program.[10] Since more Hispanic children may be eligible for the VFC program in Colorado, this might account for their overall slightly higher rates of vaccination coverage.

What are vaccine exemptions?

In Colorado, parents may exempt their child from one or more vaccines. There are three types of exemptions allowed.

- Medical exemption – a health practitioner indicates that the immunization would endanger the child's health or the child cannot be immunized due to other medical conditions.
- Religious exemption – the parent or guardian adheres to a religious belief whose teachings are opposed to immunizations.
- Philosophical/personal belief exemption (PBE) – the parent or guardian is opposed to immunizations.[11]

Exemption rates in states that allow PBEs are 2.5 times as high as rates in states that only permit religious exemptions.[12] States like Colorado with easy PBEs (only parental signature required to opt-out) have significantly higher rates of exemption than states with more complex procedures.[13]

How does the exemption process affect the population?

A growing concern is vaccine refusal or exemptions since the impact of immunization programs depends on high rates of vaccination acceptance and coverage. Geographic clustering of refusals or exemptions is increasing in the United States and can result in outbreaks.[1] With the reduction in incidence of VPDs, public perception about the severity and susceptibility of diseases decreases which may influence vaccine refusal or exemption decisions.[1] Lower vaccination coverage leads to decreased herd immunity and ultimately a more susceptible population, where children under five years are especially vulnerable.[1]

> ***Herd* or *Community* Immunity[8]**
>
> Immunity that occurs when the vaccination of a significant portion of a population provides protection for individuals who have not developed immunity.

Ease of obtaining PBEs may play a role in high rates of VPDs. In states with an easy exemption process the incidence of pertussis was 41 percent higher than in states with more restrictive methods (i.e. health care professional's signature, notarized form, or a letter of explanation).[2,12] Research shows that Colorado children whose parents claim exemptions are 22 times more likely to acquire measles, 23 times more likely to acquire pertussis and 9 times more likely to acquire varicella.[8,14] Children with PBEs are at increased risk for measles and pertussis[14] and can infect others too young to be vaccinated, who cannot be vaccinated for medical reasons, and who are pregnant or have immune system problems.[1] A strong association between parental vaccine refusal or exemptions and increased risk of VPD infection exists among Colorado children.[3] Child care outbreaks and areas with high rates of exemptions increase the risk of transmitting VPDs to both unvaccinated and undervaccinated children and vulnerable populations in Colorado.[13]

Why do parents have doubts about vaccines?

Almost 45 percent of parents who report intentionally delaying vaccinations for their children do so because of vaccine safety and efficacy concerns.[15] Based on research using 2003 and 2004 NIS data, 28 percent of parents reported ever getting their child vaccinated although they were not sure it was the best thing to do ("unsure"), delaying a vaccination for their child ("delayed"), or deciding not to have their child vaccinated ("refused").[16] The majority of parents who changed their minds about delaying or refusing a vaccination for their child reported "information or assurances from health care provider" as the main reason.[16]

Current rates in Colorado for vaccines fall short of levels needed to prevent disease.[8] This coupled with an increasing trend of parents delaying or refusing to vaccinate their children and concern about vaccine safety makes Coloradans more vulnerable to incidence or outbreaks of VPDs. Efforts to educate parents and the public about the safety and benefits of childhood immunizations for child care, the development of a tutorial for primary care providers to help them address parental concerns, and strategies to make the PBE process more strict may help to improve Colorado's vaccination coverage rate to meet HP2020 goals in the future.[13,16]

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Appendix

Table 1. Colorado Child Care (age 0-5, before school entry) Vaccination Requirements, 2014-2015.[7]

Age of child	# of required doses **DTaP** Diphtheria, Tetanus, Pertussis	# of required doses **Polio** *Polio*	# of required doses **MMR** Measles, Mumps, Rubella	# of required doses **Hib** *Haemophilus influenzae* type b	# of required doses **Hep B** Hepatitis B	# of required doses **Varicella** *Chickenpox*	# of required doses **PCV7 or PCV13** *Pneumococcal Disease*
By 4 months	1	1		1	1		1
By 6 months	2	2		2	2x		2~
By 8 months	2	2		2	2x		3/2~
By 12 months	3	2		4/3/2 §	2x		3/2~
By 15 months	3	2	1+	4/3/2/1 §	2x	1*	4/3/2~
By 19 months	4	3	1	4/3/2/1 §	3x	1	4/3/2~
By 2 years	4	3	1	4/3/2/1 §	3x	1	4/3/2/1~
By 3 years	4	3	1	4/3/2/1 §	3x	1	4/3/2/1~
By 4 years	4	3	1	4/3/2/1 §	3x	1	4/3/2/1~

+ MMR given more than 4 days before the 1st birthday is not a valid dose. That dose must be repeated. Documentation of 1 dose of rubella vaccine and 2 doses of measles and 2 doses of mumps vaccines on or after the first birthday meets the school requirement for Kindergarten entry.

§ The number of Hib doses required depends on the child's current age and the age when the Hib vaccine was administered. If any dose is given at or over, 15 months, the Hib requirement is met. For children who begin the series before 12 months, 3 doses are required, of which at least 1 dose must be administered at, or over, 12 months. If the 1st dose was given at 12 to 14 months, 2 doses are required. If the current age is 5 years or older, no new or additional doses are required.

x The 2nd dose of Hep B is to be given at least 4 weeks after the 1st dose; 3rd dose to be given at least 16 weeks (4 months) after 1st dose; and last dose to be given at least 8 weeks after 2nd dose and at 6 months of age or older. (For those kids who have 3 doses prior to 7/1/09, they do not need to follow the above stated intervals.)

* If a child has had chickenpox disease and it is documented by a health care provider, that child has met the varicella requirement. Varicella given more than 4 days before the 1st birthday is not a valid dose. That dose must be repeated.

~ The number of doses of pneumococcal conjugate vaccine (PCV7 or PCV13) depends on the student's current age and the age when the 1st dose was administered. If the 1st dose was administered between 2 to 6 months of age, the child will receive 3 doses two months apart, and an additional dose between 12 to 15 months of age. If started between 7 to 11 months of age, the child will receive 2 doses, two months apart, and an additional dose between 12 to 15 months of age. If the 1st dose was given between 12 to 23 months of age, 2 doses, 2 months apart, are required. Any dose given at 24 months through 4 years of age, the PCV vaccine requirement is met. No doses required once the child turns 5 years of age.