

Childhood and Adult Immunizations

Summary

Immunizations are among public health's most significant achievements. They have contributed to the reduction of illness, disability and, in rare cases, death caused by vaccine-preventable diseases. In 2013 in the United States, national vaccination coverage levels for many routinely recommended childhood vaccines remained below *Healthy People 2020* target levels. Coverage varies substantially by state and within states and tends to be lower among children in families with incomes below the federal poverty level.¹ In 2013, among children 19–35 months old in Washington State, estimated vaccination coverage for 4:3:1:4:3:1:4 (four doses DTaP; three doses polio; one dose measles, mumps and rubella; full series - three or four doses - *Haemophilus influenzae* type b (Hib); three doses hepatitis B; one dose of varicella and four doses pneumococcal conjugate vaccine) was 71% ($\pm 8\%$), statistically similar to the 2012 rate of 65% ($\pm 7\%$) and also to the national rate of 70% ($\pm 2\%$).^{1,2} Washington has shown a steady increase in varicella (chicken pox) vaccine coverage since 1996 and, in 2013, the Washington rate of 92% met the *Healthy People 2020* target of 90% for the first time. Still, Washington has communities where substantial portions of the population choose to delay or refuse specific vaccines, as shown in school exemption rates. This contributes to outbreaks of diseases such as pertussis (whooping cough) and measles.

Nationally, an estimated 148,000 influenza-related hospitalizations occur annually among all age groups.³ Between the 1976–2006 flu seasons, the number of influenza-associated deaths ranged from 3,000 to 49,000. More than 90% of deaths related to

Definition: The standard measure of appropriate immunization for 19–35 month old children is a series of vaccinations that include ≥ 4 doses DTaP; ≥ 3 doses polio; ≥ 1 dose measles, mumps, and rubella; full series (3 or 4 doses) *Haemophilus influenzae* type b (Hib); ≥ 3 doses hepatitis B; ≥ 1 dose of varicella; and ≥ 4 doses pneumococcal conjugate vaccine (4:3:1:4:3:1:4). For adults 65 and older, the standard measures are the proportions immunized for influenza within the past 12 months and ever vaccinated for pneumococcal disease.

influenza are in people 65 years and older.⁴ The 2012 Behavioral Risk Factor Surveillance System survey for Washington estimated 60% ($\pm 2\%$) of adults 65 and older were immunized for influenza in the previous year, and 73% ($\pm 2\%$) were immunized for pneumococcal disease. These levels are comparable to the national rates.

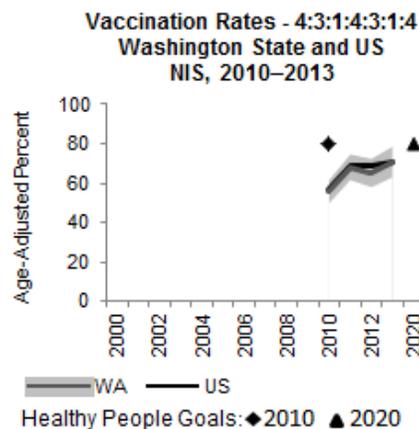
Childhood Immunizations

Time Trends

Similar to the United States, Washington's coverage rate for the 4:3:1:4:3:1:4 series (see [Definition](#) above) of vaccinations has shown a generally upward trend since 2010 when it was first measured by the National Immunization Survey (NIS).

However, estimates of coverage from 2012 and later are not directly comparable to those of preceding years due to changes in the NIS methods. The number of interviews conducted by cell phone greatly increased with approximately 50% of the unweighted NIS sample coming from the cellular telephone sampling frame in 2012 compared with 11% in 2011.²

Washington's rate is similar to the U.S. rate.



Year 2010 and 2020 Goals

The *Healthy People 2020* goal is to increase the proportion of children ages 19–35 months covered by the 4:3:1:4:3:1:4 vaccination series to 80%. This is the same as the *Healthy People 2010* goal. National and Washington rates for 2013 are 70% ($\pm 2\%$) and 71% ($\pm 8\%$), respectively. In 2010, Washington's rate for the 4:3:1:4:3:1:4 series was 55.7% ($\pm 6\%$). With a continuing increase in coverage rates for varicella, it is expected that Washington's rates for this series will continue to increase, approaching the goal for 2020. Future revisions to the national goals may include goals for new vaccines when they are added to the Advisory Committee on Immunization Practices (ACIP) schedule of recommended vaccines.

The *Healthy People 2020* goal for immunization registries—the same as the *Healthy People 2010* goal—is to have 95% of children younger than age six with two or more immunizations in a population-based registry. Washington State has already met this standard of participation in the Washington State Immunization Information System (WAIIS) for children under six years of age. In 2011, a total of 22 states were documented as having met this goal.⁵

Geographic Variation

The NIS provides annual estimates of immunization coverage for states and selected urban areas but does not include individual counties. In 2010, the 4:3:1:4:3:1:4 series rate for 19–35 month old children was 58% ($\pm 8\%$) for eastern Washington counties and 55% ($\pm 7\%$) for western Washington counties. When special analyses were performed by CDC for selected counties with 2007–2008 NIS data, the 4:3:1:3:3:1:4 series rate (hib vaccine listed as ≥ 3 rather than 4) for the seven Washington counties included varied from 62% to 69%.⁶ More recent sampling by geographic areas within Washington State has not been done.

Age and Gender

The NIS measures only vaccination rates of children ages 19–35 months. There are no differences in 4:3:1:4:3:1:4 coverage within this age span among Washington children, nor are there gender differences.

Economic Factors and Education

Children surveyed in the NIS are grouped as “at or above” or “below” the poverty level or “unknown poverty level.” During 2010–2013, the NIS found that the coverage rate for the 4:3:1:4:3:1:4 vaccination series was significantly lower (by 6%–9% nationally) for children living below the poverty level than for children living at or above the poverty level. Current data and estimates on differences by the educational level of the mother are not yet available.

Race and Hispanic Origin

The 2013 NIS immunization national coverage for the 4:3:1:4:3:1:4 vaccination series among children 19–35 months of age showed that black, non-Hispanic children had lower coverage compared with white children though this was no longer true after adjustment for poverty status. State estimates were not available.¹

Other Measures of Impact and Burden

Immunization rates at school entry. In the school year 2012-2013, 86% of Washington State kindergarten students met all school-entry vaccine requirements. Overall, the Washington State school immunization coverage rates were similar during school years 2008-2009 to 2012-2013. The *Healthy People 2020* goal for individual vaccines at school entry is 95%. Currently none of the vaccines required for kindergarten in Washington meet this goal.

School exemption rates show a decreasing trend. In school year 2012–2013, only 5% of kindergarten students had exemptions to school-entry vaccination requirements, compared with a high of 8% in school year 2008–2009. There are four types of exemptions in Washington State currently: Personal/philosophical, Religious, Religious Membership and Medical. Personal/philosophical exemptions continue to represent the vast majority (over 84%) of exemptions requested in Washington State. Recent studies show that clusters of children exempted for personal reasons have played a role in pertussis and measles outbreaks.^{6,7,8}

A number of factors may have contributed to the growing number of students meeting school vaccination requirements and the decrease in exemptions. In 2009, Washington State separated the exemption request form from the Certificate of Immunization Status. A law was passed in 2011 that requires a healthcare provider signature for most exemption requests to indicate that the provider discussed the benefit and risk of vaccinations with

the parent. The law also allows for exemptions with only a parent signature attesting to membership in a religious body that does not believe in medical treatment from a healthcare practitioner.

Delayed onset of immunizations. Vaccine delay in children under one year of age puts them at risk for serious diseases, such as pertussis, when the risk of complications and death is highest.⁹ Vaccine delay can also lead to their not completing the full vaccination series.

Cost. Vaccines are cost-effective on the societal level by the prevention of many cases of disease and death, and many are cost-saving. Every dollar spent in the United States on routine childhood immunizations saves at least \$10 in direct and indirect costs to society over a child's lifetime, with an overall net savings of \$69 billion.¹⁰

Morbidity. Since the varicella vaccine became available in the United States in 1995, chicken pox rates have been declining among all age groups. Overall, the rate declined 82% from 2000 to 2010 in the 26 states that had adequate and consistent reporting to the National Notifiable Disease Surveillance System.¹¹ In Washington, between 2000 and 2012, the rate of chicken pox in children under the age of 18 years declined from 35 to 8 per 1,000 children. The decline in varicella cases is attributed to the increased use of varicella vaccine.

Pertussis in Washington State has become an increasing concern especially since the epidemic of 2012-2013. This is discussed in greater detail in the *Health of Washington State* Pertussis chapter.

Risk and Protective Factors

Missed opportunities for administration of vaccines. A missed opportunity is defined as any healthcare provider office visit at which a child does not receive all needed vaccinations that could have been safely and appropriately administered. Most missed opportunities occur during acute care visits or health supervision and follow-up visits. Several studies have shown that vaccination coverage could be increased up to 20 percent by eliminating missed opportunities.¹²

Challenges to receiving vaccinations on time. Many children do not receive all vaccinations within the recommended time frame. A recent study has shown that up to half

of babies in the United States miss or delay at least some of the recommended vaccinations.¹² Other studies have shown that over one-third of children were undervaccinated for over six months¹³ and that children in western states have lower rates of on-time vaccinations than children in eastern states.¹⁴

Barriers. Barriers to immunizations include physical ones such as distance to travel, transportation problems, and inconvenient clinic hours and waiting times, as well as psychological barriers such as unpleasant experiences, complexity and continual change of the immunization schedule, and concerns and fears over vaccine safety.¹⁵ Also of importance are family financial barriers to accessing primary care coupled with the situation that some providers are stopping providing immunizations due to diminishing reimbursements for those services.¹⁶

Protective factors. NIS data indicate that children 19–35 months old who are the firstborn child are more likely to be fully immunized with age-appropriate recommended vaccines than children who have older siblings. These findings suggest it may be helpful for immunization providers to pay particular attention to the vaccination status of children who are not firstborn. NIS data also suggest that children whose mothers are married or who have never been married are more likely to be fully vaccinated than children whose mothers are widowed, divorced, separated or deceased.

Intervention Strategies

No research has identified any single specific way to increase childhood immunization rates. Best practice guidance and reports from states that have sustained high immunization rates indicate that combining one or more tactics from the following set of activities contribute to improved immunization rates.^{17,18}

- Assuring convenient access to vaccines and primary care.
- Provider recommendations given directly to the families.
- Client recall and reminder systems to notify families that vaccinations are needed.
- Clinic and community assessments to measure rates, provide feedback, and promote best practices.
- An immunization registry with provider access to support clinical decision making for individual patients and to provide community and statewide coverage data to drive interventions and support outbreak response.

- Health promotion materials that provide information to parents and providers to help with decision making about giving children the right immunizations at the right time.
- Communication and social marketing to make receiving the right immunizations at the right time a cultural norm.
- Policy development to assure laws and rules effectively support immunization services and high immunization rates.

Washington State Immunization Information System. The Washington State Immunization Information System (WAIS) and the Child Profile Health Promotion system are designed to maximize the likelihood that children receive the preventive healthcare they need. They are also used to help medical providers improve and maintain high immunization rates. The WAIS contains records on approximately 7.7 million individuals, with more than 68 million vaccinations recorded. The health promotion component, Child Profile, sends immunization reminders and other well-child information to families of children from birth to age six. Immunization reminder systems are a best practice strategy for increasing immunization rates.^{17,18} Although its emphasis remains on young children, the registry also has records on many teens and adults.

Universal purchase of all routinely recommended vaccines. The Washington Vaccine Association (WVA), an independent, nonprofit organization, was formed by the state legislature in 2010 to assure continued access to all ACIP-recommended childhood vaccines birth through age 18 for all children in Washington State at no cost to a family for the vaccine. The WVA administers the flow of vaccine funds by collecting payments from health plans, insurance companies, and other payers and remitting the funds to the state which purchases the vaccines. The universal vaccine distribution system also promotes vaccination in a child's medical home—a strategy that shows potential to increase immunization rates.¹⁹

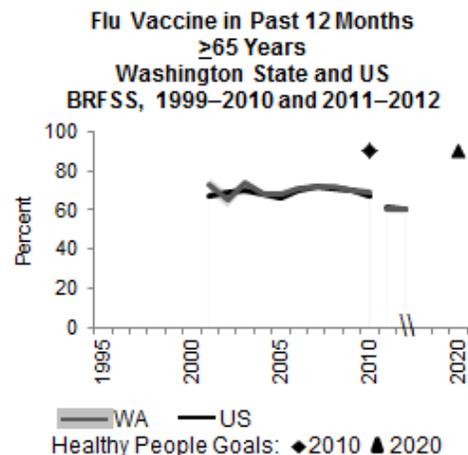
Provider assessment. AFIX (Assessment of rates, Feedback of results to providers, Incentives to recognize performance, and eXchange of information among providers) is a quality improvement strategy focused on improving clinic immunization practices and coverage rates. Assessments include evaluating the clinic's immunization coverage rates for two-year-old patients, 13–18-year-old patients, or

both age groups. The clinic's use of evidence-based immunization practices and identification of opportunities for improvement are also included. AFIX is recommended as an evidence-based practice to improve immunization coverage rates by the Community Preventive Services Task Force.¹⁷ The Centers for Disease Control and Prevention requires AFIX site visits as a component of all immunization programs.²⁰ In 2013, local health jurisdiction or state Department of Health staff conducted about 240 AFIX site visits in clinics across Washington. This number represents the CDC-recommended target of about 25% of clinics enrolled in the Washington State Childhood Vaccine Program.

Adult Immunizations

Time Trends

On the 2012 Washington [Behavioral Risk Factor Surveillance System \(BRFSS\)](#) survey, about 60% (+2%) of Washington residents 65 and older reported receiving an influenza vaccine in the previous 12 months. Data for 2011 and 2012 are not comparable to earlier years due to changes in methods for collecting and analyzing BRFSS data. (See BRFSS Caveats in [Appendix B](#).) Earlier BRFSS data found that the proportion of Washington residents 65 and older receiving a flu vaccine in the previous 12 months varied between 1999 and 2010 from a low of 68% (±2%) in 2005 to a high of 73% (±4%) in 2001.



In 2012, 73% (+2%) of Washington adults reported ever having received a pneumococcal vaccination. Flu vaccinations are recommended yearly because the vaccine components are designed to match the circulating flu viruses each year; for most people, pneumococcal vaccines are only needed once after

age 65. While Washington's rate for flu vaccination is similar to the U.S. rate, Washington's rate for pneumococcal vaccination is higher.

Year 2020 Goals

The *Healthy People 2020* goal is to increase the proportion of non-institutionalized adults ages 65 and older who were vaccinated in the past year against influenza disease to 90% and who were ever vaccinated against pneumococcal disease to 90%. These are the same goals as listed for *Healthy People 2010*. Based on the 2012 BRFSS data, Washington's rate for flu vaccine is 60% ($\pm 2\%$) and the rate of having ever received a pneumococcal vaccination is 73% ($\pm 2\%$). Washington's coverage rates for these two vaccines have not been increasing, and it appears unlikely that the state will achieve the target of 90% for either flu or pneumococcal vaccination by 2020.

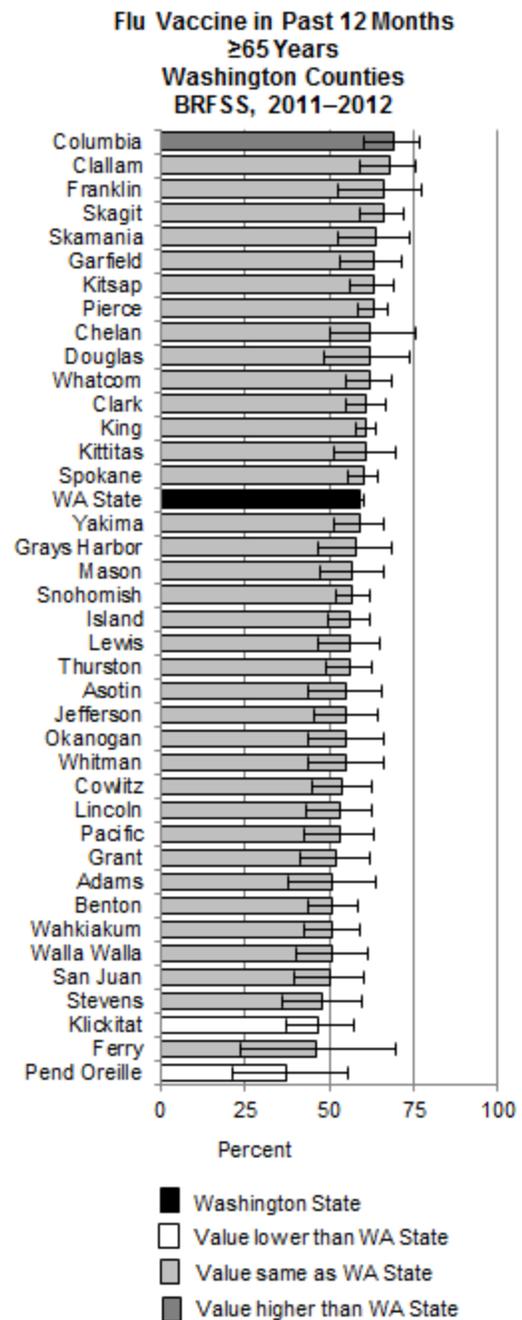
Geographic Variation

Based on the 2011–2012 BRFSS data, rates of flu vaccination for residents ages 65 and older in Washington counties ranged from a low of 37% to a high of 69%. Klickitat and Pend Oreille counties had lower flu vaccination rates than the state as a whole. Only Columbia County had a higher rate than the state as a whole.

Franklin and Whatcom counties had higher rates of vaccination against pneumonia for people who are 65 and older than the state as a whole; Grant County had a lower rate. (Data not presented.)

Age and Gender

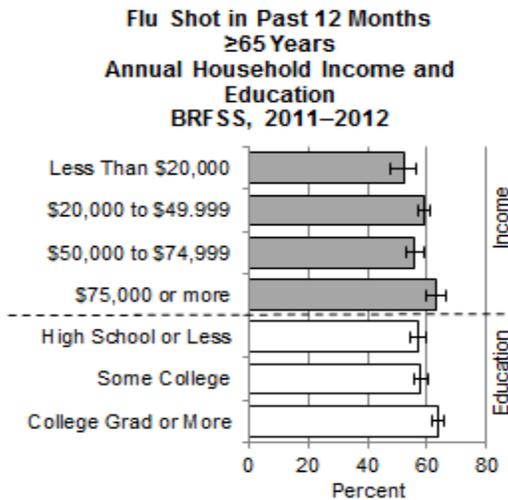
Vaccinations for both influenza and pneumococcal diseases have been strongly recommended for people ages 65 and older for many years. But a more recent recommendation is that all persons six months of age and older, and particularly people ages 50 and older and those with chronic medical conditions, should get flu vaccination annually.²¹ Based on the 2011-2012 BRFSS data the coverage rate in Washington for flu vaccination in the previous 12 months for people ages 50–64 was 33% ($\pm 1\%$), significantly lower than the rate of 60% ($\pm 2\%$) among those 65 and older.



Again based on the 2011-2012 BRFSS data, in Washington, there were no gender differences in rates of flu immunization among people ages 50–64 years. Women ages 65 and older were significantly more likely to have been vaccinated against flu in the past year and ever vaccinated against pneumonia than men.

Economic Factors and Education

Based on the 2011–2012 BRFSS data, Washington residents ages 65 and older with an annual household income of less than \$20,000 were less likely to report receiving flu shots in the previous year than residents with higher household incomes.

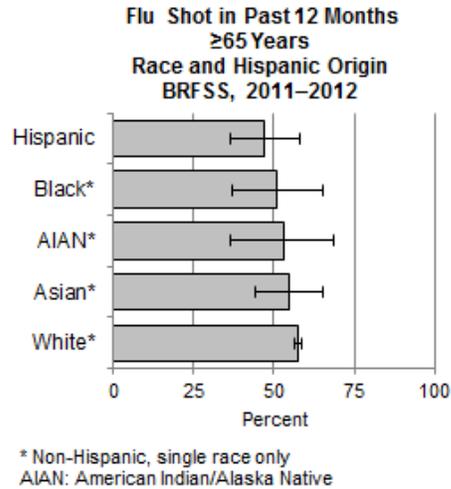


But both the highest and lowest income categories were more likely to report receiving pneumococcal vaccination than those with annual incomes between \$20,000 and \$75,000.

Similarly, while college graduates ages 65 and older were slightly more likely to report having been vaccinated for flu in the previous year than other residents the same age, education was not associated with vaccination against pneumococcal disease.

Race and Hispanic Origin

Based on the 2011–2012 BRFSS data, race and Hispanic origin were not significantly associated with reporting receiving flu shots among Washington residents ages 65 and older. Washington residents ages 65 and older who were non-Hispanic white were more likely to report ever having received a pneumococcal vaccination compared to Asians and Hispanics.



Other Measures of Impact and Burden

Hospitalizations and deaths. Hospitalizations and deaths from influenza and pneumonia are much higher among people 65 and older, young children, and people with chronic medical conditions.^{4,22} In the United States, adults 65 and older account for 90% of deaths caused by influenza and pneumonia.⁴ The rate of influenza-related hospitalization in the 65 and older population is almost three times or more the rate in any other age group.²² The number of U.S. influenza-associated deaths has increased since 1976, which may be partially due to the increase in the size of the population aged 65 and older.⁴

In Washington, there were 54 laboratory-confirmed influenza-related deaths in the 2012–2013 flu season. Among these, 46 (85%) were persons 65 years of age and older for a rate of 6 per 100,000 population.²³

Cost-effectiveness of the influenza vaccine.

Vaccinating adults 65 and older against influenza is cost-effective.^{24,25,26,27,28} One study of six cohorts who were members of a large U.S. health maintenance organization (HMO), each including more than 20,000 adults ages 65 and older, found that influenza vaccination saves an average of \$73 per person vaccinated in direct medical care costs.²⁴

Risk and Protective Factors

Special populations. Pregnant women are also at increased risk of developing serious influenza-related complications and hospitalization.^{29,30}

Several studies showed increases in pregnancy complications, including fetal death, congenital anomalies, preterm and small for gestational age infants, in cohorts of women with influenza.^{31,32,33,34} Despite these risks, the percentage of women in

Washington reporting having received the flu vaccine during pregnancy is low, only 54% during the 2010-2011 flu season.

Nursing home residents have a higher incidence of influenza and pneumonia than non-institutionalized adults ages 65 and older. This may be partially due to the high incidence of chronic medical conditions among nursing home residents. During influenza outbreaks in long-term care facilities, attack rates among residents have ranged as high as 25–60%, with case-fatality rates of 10–20% and, during epidemics, overall mortality rates of 5% or more.^{35,36,37}

Vaccine efficacy. Each year, the influenza vaccine is formulated to combat strains that are expected to occur in that particular year. Vaccine efficacy varies depending on how well the vaccine matches the most commonly circulating influenza viruses, the age of the vaccine recipient, and many other factors. The influenza vaccine has been shown, in some earlier studies, to be 30%–70% effective at preventing hospitalizations for influenza and pneumonia among people ages 65 and older who do not live in nursing homes or chronic-care facilities.^{25,27,38} One study found that, over three influenza seasons, vaccination was associated with a 50% reduction in deaths from influenza, pneumonia, all acute and chronic respiratory conditions, and congestive heart failure.²⁴ However, in years when the match between the vaccine and the circulating viruses is poor, the efficacy is likely to be lower.

Vaccination of close contacts and healthcare workers. Influenza and pneumococcal vaccinations are less effective among people ages 65 and older, people who have senescent immune systems, and people with chronic medical conditions. These vaccines lower the risk of severe illness as well as secondary complications and deaths, but the somewhat reduced vaccine efficacy in these vulnerable groups has led to the recommendation that healthcare workers and close contacts such as family members receive annual influenza vaccinations to help prevent the spread of influenza to these at-risk populations.^{30,39,40,41,42}

Intervention Strategies

*The Guide to Community Preventive Services*¹⁷ and the *Standards for Adult Immunization Practice*⁴³ provide information on several interventions proven to increase vaccination

coverage rates among adults. These evidence-based interventions include:

Standing orders. Standing orders allow non-physician medical personnel to assess and administer vaccinations without direct physician involvement at the time of vaccination. When used alone, standing orders can improve vaccination coverage rates by 53%.¹⁷ This intervention is effective across multiple healthcare settings, child and adult populations, and vaccines. Standing orders decrease the burden on physicians, increase clinic efficiency, and reduce missed vaccination opportunities.¹⁷

Client and provider reminder/recall. Client reminder and recall systems inform clients that they are due or overdue for a vaccination. Provider reminder and recall systems inform providers when a client is due or overdue for vaccinations. These strategies effectively improve immunization rates at the healthcare practice and community level among all age groups. Client reminder and recall improves vaccination coverage on average up to 12% when used either alone or in conjunction with education, expanding access in healthcare settings, and other evidence-based strategies.¹⁷ Provider reminder and recall can improve vaccination coverage rates by 16%.¹⁷ Providers who participate in the Washington State Immunization Information System can generate client and provider reminder/recall lists that make it more efficient to implement these strategies.

Decreasing out-of-pocket costs. Out-of-pocket costs for vaccination can be reduced by providing free vaccinations, decreasing administrative costs, providing insurance coverage, and decreasing co-payments. These strategies can improve vaccination coverage by 22% on average when used alone or as part of a multi-component intervention.¹⁷

Provider assessment and feedback. This intervention includes assessing provider performance in delivering one or more vaccinations and giving feedback on performance. When used alone, provider assessment and feedback can improve vaccination coverage by 16% on average. It is effective across a wide range of providers, client populations and healthcare settings.¹⁷

Multi-component interventions that include education. Education, including information about new vaccines, can increase community awareness of the importance of vaccinations and tell people how to access vaccination services. There is insufficient evidence to show that education alone will improve vaccination coverage. When education is combined with other interventions, such as client

reminders and expanded access, it can improve vaccination rates by an average of 16%.¹⁷ This type of intervention is effective at both the clinic and community level.¹⁷

Data Sources (For additional detail, see [Appendix B](#).)

Washington State Immunization Information System Data Reports, December 31, 2013.

Washington State Behavioral Risk Factor Surveillance System (BRFSS) Data: 1999–2012. Olympia, Washington: Washington State Department of Health, under federal cooperative agreement numbers: U58/CCU002118 (1987–2003), U58/CCU022819 (2004–2008), U58/DP0011996 (2009–2010), and U58/SO000047 (2011–2013); data prepared by Washington State Department of Health, Office of Immunization and Child Profile.

Washington State Department of Health, Office of Healthy Communities, Pregnancy Risk Assessment Monitoring System (PRAMS) 1994–2010.

For More Information

Washington State Department of Health Office of Immunization and Child Profile (360) 236-3595 or visit our websites at

www.doh.wa.gov/YouandYourFamily/Immunization.aspx and www.waiis.wa.gov

Technical Notes

The National Immunization Survey (NIS) is a random digit dial survey conducted annually by the U.S. Centers for Disease Control and Prevention (CDC). Since April 1994, this survey has provided ongoing estimates of vaccination coverage among preschool children for the nation and all 50 states.

For analyses using influenza and pneumococcal vaccine data from BRFSS, persons who answered that they did not know if they had a particular vaccine or for whom data was missing were included with those who responded that they had not received the vaccine because both groups are considered at risk and unimmunized and would be given the vaccine when possible.

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Endnotes

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