Childhood and Adult Immunizations

Definition: The standard measure of appropriate immunization for children ages 19-35 months is a series of vaccinations that includes four doses DTP; three doses polio; one dose measles, mumps, and rubella; three doses *Haemophilus influenzae* type b (Hib); three doses hepatitis B; and one dose of varicella (4:3:1:3:3:1). For adults 65 and older, the proportion immunized for influenza within the past 12 months and ever-vaccinated for pneumococcal disease is the standard measure.

Summary

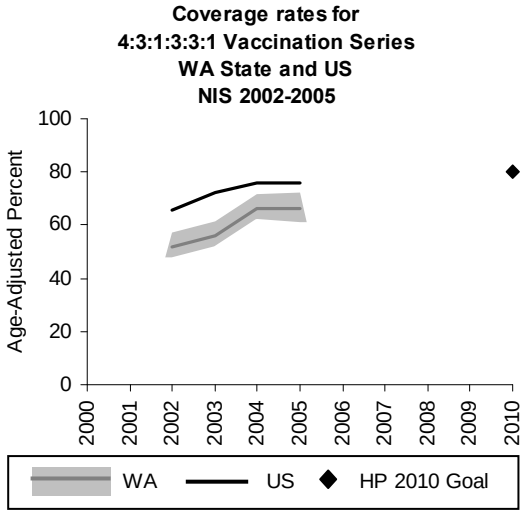
Immunizations are among public health's most significant achievements. They have contributed to the reduction of illness and death caused by vaccine-preventable diseases. In 2005 in the United States, national vaccination coverage levels for routinely recommended childhood vaccines remained at or near all-time high levels, but coverage varies substantially by state and urban areas.[1] In 2005, estimated vaccination coverage for 4:3:1:3:3:1 (four doses DTP; three doses polio; one dose measles, mumps, and rubella; three doses *Haemophilus* influenza type b (Hib); three doses hepatitis B; and one dose of varicella) among children 19–35 months old in Washington State was 66% (±6%) a nearly 15% increase over the 2002 rate of 52% (±5%) but lower than the national rate of 76% (±1%).[1,2] Washington has lagged behind the nation as a whole in the acceptance of varicella vaccine; this lag accounts for the lower rate of coverage in the 4:3:1:3:3:1 vaccination series. But Washington had a steady and significant increase in varicella (chicken pox) vaccine coverage from 1996 to 2005.

Nationally, an estimated 226,000 influenza-related hospitalizations occur annually as do 36,000 influenza-associated deaths; rates are highest among people 65 years and older and infants.[3,4] The 2006 Behavioral Risk Factor Surveillance System survey for Washington estimated 71% (±1%) of adults 65 and older were immunized for influenza in the previous year, and 70% (±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 4:3:1:3:3:1 series (see definition above) of vaccinations has improved since 2002, when it was first measured by the National Immunization Survey (NIS). Washington's rate is lower than the U.S. rate because we have lower coverage for 1+ varicella (chicken pox) vaccinations, the latest addition to this series.



Year 2010 Goals

The *Healthy People 2010* goal is to increase the proportion of children ages 19–35 months covered by the 4:3:1:3:3:1 vaccination series to 80%. National and Washington rates for 2005 are 76% (±1%) and 66% (±6%), respectively. If coverage rates for varicella continue to improve, Washington's rate for this series will be close to the 2010 goal. Future revisions to the national goals may include goals for new vaccines as they are developed and used.

Geographic Variation

The NIS provides estimates of immunization coverage for states and selected urban areas but does not include individual counties. In 2005, the 4:3:1:3:3:1 series rate for children ages 19–35 months in the Seattle-King County urban area was 69% (±8%), and it was 65% (±8%) for the rest of the state.

Age and Gender

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

Race and Hispanic Origin

There are no significant differences in immunization coverage for the 4:3:1:3:3:1 series from the 2003–2005 NIS between Washington children 19–35 months old who are white, black, or of Hispanic origin. Rates for American Indian and Alaska Native and Asian and Pacific Islander children are not available from the NIS because of small sample sizes.

Income and Education

Washington children surveyed in the NIS are grouped as "at or above" or "below" the poverty level or "unknown poverty level." During 2003–2005, the NIS also found no differences in the coverage rate for the 4:3:1:3:3:1 vaccination series for different income groups. There are also no differences by the educational level of the mother.

Other Measures of Impact and Burden

Immunization rates in school-age children have declined over the past eight years. Growing anti-immunization sentiment as well as additional vaccine requirements (such as the addition of varicella) might have contributed to this decline. In 2005-2006, 87% of Washington students had complete immunizations, below the *Healthy People 2010* goal of 95%.

As coverage rates decline, the statewide exemption rate rises. Washington is one of about 20 states that allow personal or philosophical exemptions in addition to medical and religious exemptions. Personal or philosophical exemptions account for more than 95% of Washington's total exemptions. Children exempted for personal reasons are more likely to become infected with measles and pertussis.[5]

Delayed onset of immunizations. Children who receive their first immunizations after they are three months old are more likely to remain under-immunized by the age of 24 months. This finding, along with school entry immunization data, indicates that many children remain unprotected until they start school and then receive vaccinations because they are required for school entry. This leaves infants and toddlers unprotected between two and five years of age, when they are at greater risk for complications from vaccine-preventable diseases.

Cost. Vaccines are cost-effective. Every dollar spent on routine childhood immunizations saves more than $5 in direct costs and $11 in costs to society (both direct and indirect costs).[6]

Morbidity. Beginning in 1999, chicken pox rates began to decline nationally among all age groups. The rate for children ages one through four decreased 75%, from 14.5/1,000 in 1996 to 3.7 in 2002. The rate for infants (who are not eligible for the vaccine) decreased 65%, from 11.8 cases/1,000 in 1996 to 4.1 cases in 2002. [7] In Washington, hospitalizations for chicken pox among children ages one through four decreased 47% between 2001 and 2005, from 45 to 24, respectively.

Recent studies reveal that the pneumococcal conjugate vaccine (sometimes called the pneumonia vaccine) for young children has decreased the incidence of disease among children younger than five, from 80 cases per 100,000 in 1999 to 4.6 in 2003, a 94% decline in this age group. In Washington, the number of hospitalizations associated with pneumococcal disease among children younger than five decreased 20%, from 2,200 in 1999 to 1,752 in 2005. In addition, hospitalizations of children younger than five for *H. influenzae*-caused meningitis decreased 93%, from 83 in 1990 to 6 in 2005.

Risk and Protective Factors

Missed opportunities for administration of vaccines. A missed opportunity is defined as any health care 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. Missed opportunities account for half of all under-vaccination.[5]

Challenges to receiving vaccinations on time. Many children do not receive all vaccinations on

time as recommended. Vaccinations that are administered too early might be less effective and could leave children without optimal protection against disease. In this country, children in western states have lower rates of on-time vaccinations than children in eastern states.[8,9]

Barriers. These include transportation problems, lack of access to primary care, complexity and continual change of the immunization schedule, families experiencing multiple moves or having multiple providers, and family members objecting to some vaccinations.[10]

Protective factors. NIS data indicate that children 19–35 months old who are firstborn or are 30–35 months old are more likely to be fully immunized with age-appropriate recommended vaccines than children younger than 30 months. These findings suggest it may be helpful for immunization providers to pay particular attention to the vaccination status of children who are not firstborns or who are younger than 30 months old. NIS data also reveal 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 identifies a specific way to increase immunization rates. Best practice guidance and reports from states that have sustained high immunization rates indicate that the following set of activities contribute to improved immunization rates:[11,12]

- Assuring access to vaccine
- Health promotion that gets 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 the right immunizations at the right time a cultural norm
- Clinic and community assessments to measure rates, provide feedback, and promote best practices
- An immunization registry to give providers a tool to support clinical decision-making for individual patients and to provide community and statewide coverage data to drive interventions and support outbreak response
- Policy development to assure laws and rules effectively support immunization services and high immunization rates.

CHILD Profile Immunization Registry. CHILD Profile is the Washington Immunization Registry and Health Promotion system designed to ensure children receive the preventive health care they need. It is also used to help medical providers improve and maintain high immunization rates. The system contains records on approximately 4.9 million individuals, with more than 30.8 million vaccinations recorded. The health promotion component of 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.[11]

The *Healthy People 2010* goal is to have 95% of children younger than six with two or more immunizations in a population-based registry. As of January 2007, nearly 82% of Washington children younger than six met this standard of participation in the Immunization Registry. Washington is expected to reach or come close to the goal by 2010. Although its emphasis remains on young children, the registry also has records on many teens and adults.

Universal purchase of all routinely recommended vaccines. Washington uses a combination of federal and state funding to purchase routinely recommended vaccines for all children younger than 19. This universal childhood vaccine purchasing and distribution system, which is expanded as new vaccines such as HPV become available, streamlines the delivery of vaccine services by alleviating the need for providers to screen for eligibility, to maintain separate inventories of vaccine, and to determine the insurance status of a child. The universal vaccine distribution system also promotes vaccination in a child's medical home—a strategy that shows potential to increase immunization rates. [13]

Provider assessment. AFIX (Assessment of rates, Feedback of results to providers, Incentives to recognize improved performance, and eXchange of information among providers) is a quality improvement strategy to raise immunization coverage levels and improve standards of practices at the provider level. AFIX is recommended in the U.S. Centers for Disease Control and Prevention (CDC) Standards of Pediatric Immunization Practices and by the Advisory Committee on Immunization Practices.[14] In 2006, about 290 private health care provider clinics participated in the AFIX

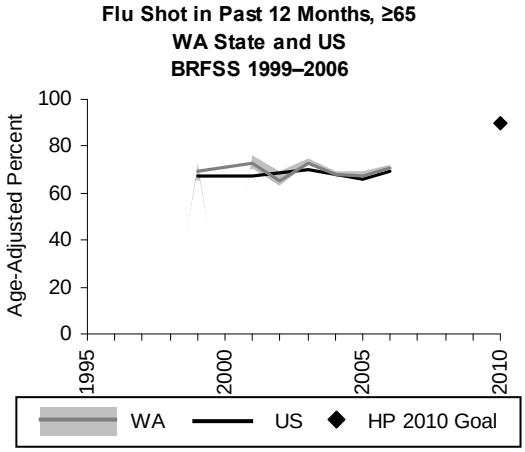
process in Washington, or about 25% of vaccine providers in the state.

Adult Immunizations

Time Trends

Overall, the proportion of Washington residents 65 and older receiving a flu shot in the previous 12 months has not changed since 1999. The rate in 2006 was slightly less than 71% (±1%).

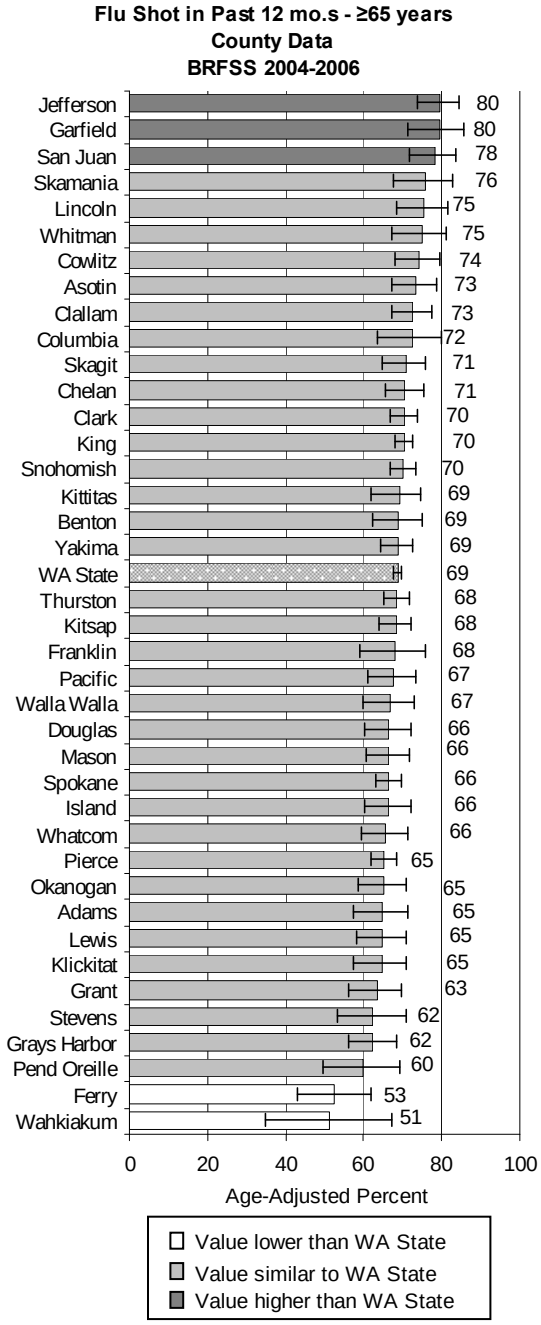
In 2006, 70% (±2%) of Washington adults reported ever having received a pneumococcal vaccination. While Washington's rate for flu vaccination is similar to the U.S. rate, Washington's rate for pneumococcal vaccine is higher.



Year 2010 Goals

The *Healthy People 2010* goal is to increase the proportion of non-institutionalized adults ages 65 and older who are vaccinated against influenza and pneumococcal disease to 90%. Washington's coverage rates for flu vaccination have not shown significant increases over the past six years, and therefore it is unlikely that the state will achieve the target of 90% by 2010.

Geographic Variation



The 2004-2006 rates of flu vaccination for residents ages 65 and older in Washington range from a low of 51% to a high of 80%. Jefferson, Garfield and San Juan counties had rates significantly higher than the state rate. Counties with flu vaccination rates for people who are 65 and older that are significantly lower than the state rate include Wahkiakum, and Ferry counties.

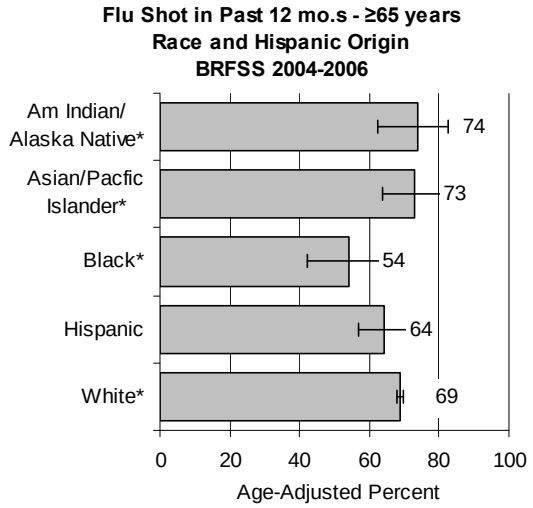
Age and Gender

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 people ages 50 and older get flu vaccination, particularly those with chronic medical conditions. In Washington, the coverage rate for flu vaccination in the previous 12 months for people ages 50–64 was 37% (±1%), significantly lower than the rate of 70% (±1%) among those 65 and older.

In Washington, there are no differences by gender for flu immunization among people ages 50–64 years or for those ages 65 and older. Women ages 65 and older are significantly more likely to have been vaccinated against pneumonia than men.

Race and Hispanic Origin

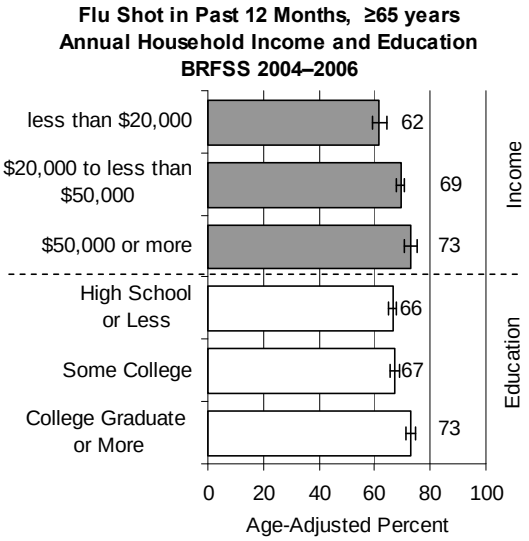
Black residents of Washington ages 65 and older during 2003-2005 had a significantly lower rate of having received a flu shot in the previous 12 months than white non-Hispanics—54% (±11%) and 69% (±1%), respectively. There were no significant differences in rates for people of other races or of Hispanic origin. There were no differences by race or ethnicity in the rates of ever having received a pneumococcal vaccination.



* Non-Hispanic

Income and Education

Coverage rates for flu and pneumococcal vaccination differed by household income and education but did not follow a common pattern. Washington residents ages 65 and older with an annual household income of less than $20,000 reported lower rates of having received flu shots in the previous year than residents with higher household incomes. But these residents reported no significant differences in ever having received a pneumococcal vaccination than residents with higher annual household incomes. Similarly, while college graduates ages 65 and older have higher rates of having been vaccinated for flu in the previous year than other residents the same age, they reported no differences in the rate of ever having been vaccinated against pneumococcal disease.



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. In the United States, adults 65 and older account for 90% of deaths caused by influenza and pneumonia. This population also accounts for 63% of all influenza-related hospitalizations. The number of U.S. influenza-associated deaths has increased since 1990. This may be partially due to the increase in the oldest age group, 85 and older.[15]

In Washington, hospitalizations for people ages 65 and older with influenza/pneumonia-related diagnoses rose steadily since 2001, from 16,734 to 20,804 in 2005. The influenza/pneumonia death rate, however, dropped during the same period from 12.5 per 10,000 in 2001 to 10.9 per 10,000 in 2005.

Cost–effectiveness of the influenza vaccine. Vaccinating adults 65 and older against influenza is

cost-effective. Findings on the cost-effectiveness of influenza vaccine vary depending on the factors used to measure costs and savings. A study of six cohorts, each including more than 20,000 adults ages 64 and older, found that influenza vaccination saves an average of $73 per person vaccinated in direct medical care costs. This study also 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.[16]

Risk and Protective Factors

Special populations. Nursing home residents have 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%.[17,18,19,20]

Pregnant women are also at increased risk of developing serious influenza-related complications. One study concluded that pregnant women are five times more likely to die from influenza-related complications than women who are not pregnant.[21]

Vaccine efficacy. Each year, the influenza vaccine is formulated to combat strains that are expected to occur. 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 is 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.[22,16] The main benefit for older adults who receive influenza vaccine is reduction in hospitalizations and death due to influenza-related complications and pneumonia.[23,24,25]

Vaccination of close contacts and health care workers. Influenza and pneumococcal vaccinations are less effective among people ages 65 and older, people who have suppressed immune systems, and people with chronic medical conditions. These vaccines lower the risk of severe illness as well as secondary complications and deaths in these vulnerable groups, but the somewhat reduced vaccine efficacy has led to the recommendation that health care workers and close contacts such as family members receive annual influenza vaccinations to help prevent the spread of influenza to these at-risk populations.[26]

Intervention Strategies

The Guide to Community Preventive Services[11] and the *Standards for Adult Immunization Practice*[27] 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 prescribe or administer vaccinations without direct physician involvement at the time of vaccination. When used alone, standing orders can improve vaccination coverage rates by 51%.[11] This intervention is effective across multiple health care settings, adult populations, and vaccines. Standing orders decrease the burden on physicians, increase clinic efficiency, and reduce missed vaccination opportunities.

Client and provider reminder/recall. Client reminder and recall is a system to inform clients that they are due or overdue for a vaccination. Provider reminder and recall is a system to inform providers when a client is due or overdue for vaccinations. These strategies effectively improve immunization rates at the practice and community level among all age groups. Client reminder and recall improves vaccination coverage on average by 8% when used alone and 16% when used in conjunction with education, expanding access in health care settings, and other evidence-based strategies.[11] Provider reminder and recall can improve vaccination coverage rates by 17% on average.[11] Providers who participate in the CHILD Profile Health Promotion and Immunization Registry 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 decreased by providing free vaccinations, decreasing administrative costs, providing insurance coverage, and decreasing co-payments. This strategy can improve vaccination coverage by 15% on average when used alone or as part of a multi-component intervention.[11]

Provider assessment and feedback. This intervention includes assessing provider performance in delivering one or more vaccinations and giving feedback on their performance. When used alone, provider assessment and feedback can

improve vaccination coverage by 16% and is effective across a wide range of providers.[11]

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%.[11] This type of intervention is effective at both the clinic and community level.[11]

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

CHILD Profile Immunization Registry Data Reports, December 31, 2006

Washington State Behavioral Risk Factor Surveillance System (BRFSS) Data: 1999–2006. 2003–2005 data weighted to reflect county over-sample, November 2006

United States Behavioral Risk Factor Surveillance System Data: 1994–2006, downloaded from http://www.cdc.gov/brfss/technical_infodata/surveydata.htm August 2007

Population Counts for State and County: Washington State Office of Financial Management, Forecasting Division, Intercensal and Postcensal Estimates of County Population by Age and Sex: 1980–2004, October 2005.

Comprehensive Hospital Abstract Reporting System (CHARS), 2001–2005; Washington State Department of Health, Downloaded from http://www.dow.wa.gov/EHSPHL/hospdata/Chars.htm

National Immunization Survey Data: 1994–2005, downloaded from http://www.cdc.gov/nis/datafiles.htm, October 2006

Washington State Death Certificate Data: Washington State Department of Health, Vital Registration System Annual Statistical Files, Deaths 1980–2005, released December 2006.

For More Information

Washington State Department of Health Immunization Program (360) 236-3595 or visit our website at http://www.doh.wa.gov/cfh/Immunize.

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, all 50 states, and 28 selected urban areas. Starting in 2007, however, estimates for selected urban areas will no longer be provided.

BRFSS data are available from 1987–present, with annual data generally available six months after the close of the calendar year. The 2006 BRFSS dataset became available midway through the process of writing *The Health of Washington State, 2007.* Some authors incorporated the 2006 data, while others presented data through 2005. The 2006 data are most important for point estimates of the state as a whole, such as when determining progress toward *Healthy People 2010* targets. Relationships among subgroups, mostly assessed by combining several years of data, are likely to be similar whether analysts used BRFSS data from 2003–2005 or 2004–2006.

Endnotes

[1] U.S. Centers for Disease Control and Prevention. (2006). National, state, and urban area vaccination coverage levels among children aged 19-35 months—United States, 2005. *Morbidity and Mortality Weekly Report*, *55*(36), 988-993.

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