Death and illness from infectious diseases have declined markedly in the United States over the past century and these successes are considered one of the 10 great public health achievements, according to the Centers for Disease Control and Prevention.\(^1\) Over this time, disease control resulted from improvements in sanitation and hygiene, the discovery of antibiotics, and the implementation of universal childhood vaccination programs. Immunizations also are largely responsible for the increase in life expectancy in the United States during the 20th century because of their ability to increase childhood survival of certain diseases.\(^2\) Immunizations are widely available for once common childhood infectious diseases such as polio, tetanus, measles, mumps, varicella (chickenpox), and pertussis (whooping cough).

Vaccines protect individuals by inducing the production of protective antibodies against the germ, which either prevent infection from occurring or reduce the severity of illness. However, immunized people also help protect those in their home and community who are vulnerable to infectious diseases, including people with weakened immune systems that cannot receive vaccines or babies who are too young to receive vaccines. For many vaccines, when more than 90 percent of a population is immunized against a particular infectious disease, this level of immunity makes spread of infection from one person to another unlikely. Even individuals not vaccinated are offered some protection because the disease has little opportunity to spread within the community. This concept is referred to as ‘herd immunity’.\(^3\)

**How is it measured?**
The incidence of vaccine-preventable infectious diseases is measured through public health surveillance systems at the local, state, and national level. In Colorado, the State Board of Health determines which conditions and diseases are required to be reported to state and local health departments. Immunization rates in Colorado are most commonly assessed through school-based audits conducted by the Colorado Department of Public Health and Environment. Additional data also is available through parent and health care provider surveys that are performed at the national level by the Centers for Disease Control and Prevention.

**How are we doing in El Paso County?**
The diphtheria-tetanus-pertussis (DTaP) vaccine is recommended for all children between the ages of 2 months and 18 months who do not have a medical contraindication to vaccination. In Colorado in 2010, 86.0 percent of children ages 19 to 35 months had received four DTaP doses, with no significant change in uptake since 2008 (86.5 percent).\(^4\) With immunization levels being lower than desired, pertussis remains prevalent in our community. Figure 1 shows the rate of pertussis by age group in El Paso County from 2008 to 2010.\(^5\) Infants have
the highest rate of pertussis infection at 31.5 cases per 100,000 population, and suffer the most severe consequences including prolonged illness, hospitalization, and death. However, a substantial number of pertussis cases occur in adults ages 18 years and older (29 percent of all cases between 2009 and 2011). Adolescents and adults with pertussis may have delayed diagnosis or not seek medical care at all, but are infectious and can spread disease within their homes, workplaces, or schools.

The pneumococcal conjugate vaccine (PCV) protects children against several types of infections caused by *Streptococcus pneumoniae*, such as bloodstream infection and meningitis. PCV is recommended to be administered in four doses to children between the ages of 2 months and 15 months. In Colorado in 2010, 81.6 percent of children ages 19 to 35 months had received four PCV doses, showing no difference since 2008 (82.5 percent). Serious pneumococcal infections disproportionately impact the health of infants and young children as well as elderly adults (Figure 2). For children, the highest rates of infection are for those under 1 year of age; and among adults the rate of disease rises markedly for people 65 years and older (who are at higher risk for pneumonia).

Adult pneumococcal vaccine (also referred to as the ‘pneumonia’ vaccine) is recommended for people 65 years and older, and national data shows that in 2010, coverage was 59.7 percent overall. Among people ages 65 years and older, non-Hispanic whites had higher vaccination coverage (63.5 percent) compared with Hispanics (39.0 percent), non-Hispanic blacks (46.2 percent), and non-Hispanic Asians (48.2 percent). In El Paso County, nearly three-quarters of senior adults had reported ever receiving a pneumococcal vaccine (2009 to 2010).7

The Colorado Board of Health requires children entering kindergarten to have received vaccinations for DTaP; measles, mumps, rubella (MMR); polio; hepatitis B; and varicella, unless an exemption has been made for religious or medical reasons.8 Statewide for the 2010 to 2011 school year, between 79 and 93 percent of kindergartners entered school being up-to-date on these required vaccines, with MMR having the lowest compliance. Overall, 6.3 percent of kindergartners exempted from one or more required vaccines. The percent of kindergartners who claimed an exemption was highest for varicella and MMR and lowest for DTaP.

Data on immunization rates for adolescents shows more variability, in part because newer vaccines have just recently been recommended and more time is needed before a vaccine is commonly used in the population. Certain adolescent vaccines serve to boost immunity that has been lost over time from childhood immunizations (e.g., MMR). Other immunizations are recommended for adolescents because this age group is more susceptible to certain diseases (e.g., meningitis, human papillomavirus). Table 1 shows the percent of Colorado youth ages 13 to 17 years who are up to date on recommended vaccinations. More than 85 percent of adolescents have received the MMR and pertussis (Tdap) booster doses; however, less than 60 percent are receiving the vaccine to prevent meningitis and only 40.9 percent of females have received the human papillomavirus vaccine.

![Figure 2. Rate of serious pneumococcal infection, by age group, El Paso County 2009 to 2011](image-url)
Table 1. Percent of Colorado adolescents ages 13 to 17 years who received recommended vaccines, 2010

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Percent of adolescents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tdap</td>
<td>85.7%</td>
</tr>
<tr>
<td>Meningitis</td>
<td>59.6%</td>
</tr>
<tr>
<td>MMR</td>
<td>92.6%</td>
</tr>
<tr>
<td>HPV (females only)</td>
<td>40.9%</td>
</tr>
</tbody>
</table>

Figure 3. Percent of Colorado kindergarteners up-to-date on required immunizations at school entry, 2010-11 school year

“The Colorado Board of Health requires children entering kindergarten to have received vaccinations for DTaP; measles, mumps, rubella (MMR); polio; hepatitis B; and varicella, unless an exemption has been made for religious or medical reasons. Statewide for the 2010 to 2011 school year, between 79 and 93 percent of kindergartners entered school being up-to-date on these required vaccines, with MMR having the lowest compliance.”

4 Centers for Disease Control and Prevention [Internet]. 2007-2010 National Immunization Survey Data [Internet]. Available from: www.cdc.gov/vaccines/stats-surv/nis/default.htm#nis.